Analyzing the Communication between the Public Safety Authorities and the Population in Crisis Situations

Katharina Dzubenko
Fakultät für Mathematik und Informatik
Fernuniversität Hagen
Universitätsstraße 47, Hagen, Germany
k.dzubenko@web.de

Simon Nestler
Fakultät Informatik
Technische Hochschule Ingolstadt
Esplanade 10, Ingolstadt, Germany
simon.nestler@thi.de

ABSTRACT

The effective and efficient use of communication technologies between the public safety authorities and the population is essential for coping with crisis situations. Therefore, the aim of this work is to examine the means of communication which are used by the public safety authorities in Germany. A survey among the relief workers was planned, conducted and analyzed on the basis of a custom questionnaire. The evaluation of the results revealed that the public safety authorities mainly use traditional media such as radio or the daily newspaper to communicate with the population in crisis situations. In the future, the communication between public safety authorities and the population will benefit from bidirectional communication channels, and thus the population's feedback will improve crisis communication. At the moment, social media is the best solution to reach this goal and to bidirectionally communicate with the population in crisis situations. It can be assumed that social media interactions only take place if these communication channels have established themselves in everyday life between the public security authorities and the population; in addition, the reliability of the technology must be stable so that those affected in a crisis situation can expect that the use of the medium helps them to successfully manage the crisis situation.

CCS CONCEPTS

CCS → Human-centered computing → Human computer interaction (HCI) → Empirical studies in HCI

KEYWORDS

Human-computer interaction, Crisis situation, Public authorities, Disaster communication

1 Introduction

Through the increasing digitalization of communication technology and the rapid networking of media in recent decades, as a consequence there has also been a transformation in the way the population uses the media [27]. More and more people today tend to use digital communication devices and technologies.

In the event of a crisis situation, the relief workers are dependent on efficient and transparent communication in order to successfully and quickly cope with the hazardous situation. For this purpose, it is necessary to achieve crisis-relevant exchange of information between the relief workers and large sections of the population [11].

Especially people in densely populated areas are particularly vulnerable to attacks, mass panics, pandemics and other forms of destruction [3]. If the communication infrastructure fails, both the classic and the new communication media can only be used to a limited extent or not at all. Most means of communication and the technology that supports them work with electricity, whether directly, such as TVs and receivers, or indirectly, such as a smartphone or a battery-powered radio. The increasing and secure use of social media and social networks could offer a potential for improving communication between public safety and the population. For this reason, a study is being carried out to find out which means of communication are used by the public security authorities in crisis situations, how often and for what purpose they are used. An essential part of the study is the use of new media for problem solving.

Thus, this work on the one hand focuses on the preparation effort (How long does it take to start using a certain means of communication?) and on the other hand focuses on the usage intensity (What differences in the usage time and frequency between the means of communication exist?). To this purpose, we carried out a data acquisition in the year 2015. This information can be used to design a communication construct from the media used to achieve the goals and tasks of the public safety authorities.

2 Context analysis

In the following chapter the context of action is presented for a better understanding. This consists of a description of the context of use and an introduction to the relevant communication model. The overall crisis context is characterized by the time-critical, life-threatening, unstable situation.

2.1 Context of use

A usage context is an interplay of components that can justify an action. The basic components describe the people involved in the action, the so-called target group, the environment, the tasks and goals, and the resources that are available.

2.1.1 Target Group. The target group was considered to be persons who belong to the public safety authorities in Germany and have experience with coping crisis situations. This target group includes both governmental and non-governmental institutions responsible for maintaining public security. State officials include, for example, the police, the fire brigade, the military, the rescue service and other internal security forces. The task of the police is to ensure internal security, to maintain public security and order in the country. The special task of the fire brigade is to provide assistance in the event of fires, floods and accidents, as well as the rescue, protection and recovery of people and animals. An important area of responsibility is taken over by the rescue service, whose main task is to save lives. The non-governmental functional bodies include non-profit associations or private companies which maintain the regulated functional structures in the country [1]. For a detailed analysis of the target group, personal data of the survey participants, such as age, occupation, position used, federal state in which the survey participant is employed, as well as the total duration of work are determined. In addition, the survey participant is asked whether he or she has experience with crisis situations, which is a prerequisite for participating in the survey.

2.1.2 Environment. For a consideration of the action in the context of use, the definition of the environment is necessary. An environment can be mainly physical or social. In this context, the environment is considered to be the situation that can trigger the action and persist during the action. The analysis refers to crises and catastrophic situations in Germany.

A crisis is defined as a "time of intense difficulty or danger" in which a change occurs at a "turning point" that determines the success or failure of the crisis [2]. It is a situation that differs from the normal state and has the potential to cause damage. A special organizational structure is necessary to cope with this situation [3]. The formation of a crisis can have different causes. On the one hand, it can be triggered by natural events such as storms, floods, heat waves or earthquakes. On the other hand, it can be caused by technical or human failure due to lack of planning, negligence or accidents. But terrorism, crime or wars can also trigger a crisis. An outbreak of a crisis can either be triggered by an event or by the way the event is managed, which then triggers the actual crisis [4]. Examples of crises caused by natural events are the floods in 2002 and 2013 on the Elbe and Danube rivers, the tsunami in 2004, hurricane Kyrill in 2007, for example the train accident in Eschede in 1998, the power failure in Münsterland in 2005, and the spread of the bird flu virus H5N1 in 2006. Examples of attacks were the terrorist attacks in New York in 2001, Madrid in 2004 and London in 2005 as well as the attempted bomb attacks in Dortmund, Koblenz in 2006 and Bonn in 2012 [5]. The course of a crisis is basically not linear and consists of three parts: the beginning, the turning point and the end. These parts can be specified in phases. The first phase forms the starting point of the crisis process and shows no visible crisis signals. Thus, the potential crisis phase is called the normal state. The following phase is called the latent phase. In this phase, the first symptoms of a crisis already appear, but they are not visible to the general public. If the crisis is recognized and treated at this time, an outbreak can be prevented. The beginning of a perceptible crisis is the beginning of the acute crisis phase. This perception is called the turning point and can no longer be overlooked. This is followed by the post-crisis phase, which requires the reintegration of ongoing processes and measures to prevent recurrence [6]. In order to prevent an outbreak of a crisis, information can be gathered, collected and evaluated as early as in the latent phase that allows conclusions to be drawn as early as possible about a crisis or at least about the time of its occurrence, so that the effects can be mitigated [7].

A surprising crisis arises unexpectedly and after the outbreak is often in the media or associated with scandals [8]. One characteristic of a crisis where no preventive measures are taken is the surprising occurrence. According to experts, the outbreak of a surprising crisis is unpredictable [9]. The surprising occurrence is an unpredictable event, since only the relevant context scenarios are considered in the context of a risk and catastrophe analysis on a large scale, out-of-context and unforeseen events are referred to as the theory of black swan events. Examples of this type of crisis were the reactor accidents at Chernobyl in 2001 and Fukushima in 2011 or the terrorist attack on the Twin Towers in New York on 11 September 2001 [10].

This condition entails the risk that the actions of the responsible unit will be monitored by the population and publicly evaluated. As a result, in addition to the damage caused by the crisis situation, the image of those responsible can also be damaged, which can result in a loss of confidence [4]. A well-prepared and proven crisis communication strategy must be in place to successfully manage the crisis and protect those responsible from serious damage to their image. Data from the risk analysis flows into the strategy, which provides information on which type of crisis an authority should pursue which crisis prevention for. In addition, information on the target group to be addressed can also be taken from the risk analysis [7]. The indispensable adjustments to avoid, prevent, detect and manage a crisis, as well as its follow-up, are called crisis management. According to the definition, a catastrophe and major loss events belong to the category of crises. According to the definition of the federal states and the Federal Office for Civil Protection and Disaster Relief, a disaster is an event that endangers or damages the lives and health of numerous people or animals, the environment, considerable material assets or the vital provision of the population to an unusual degree. The competent authority for disaster control is responsible for the management of defense against these events [3]. However, the terms crisis and catastrophe are not completely congruent from

the state's point of view and in the common language of the population [11].

2.1.3 Resource. In the choice of communication media, both classic and new media were considered. Classical media include means of communication such as broadcasting, satellite radio, acoustic warning devices and print media. The broadcasting includes other means of communication such as radio and television. This means the transmission of information of any kind in image, sound and text to the public via electromagnetic waves. The satellite radio comprises all radio applications required for technical communication via satellite-based networks. This includes media such as the information telephone, the emergency fax, an early warning system, generated e-mails or SMS.

The acoustic warning device is a means of communication that is used to alert the population by means of a special loud sound. This includes the loudspeaker car, the area-wide siren and the mobile warning vehicle. The print media serve as a source of information for citizens to follow current events. Daily newspapers, magazines and flyers fall into this category. New media in crisis communication represent the social media. Social media are digital media that allow users to exchange information and share content. Social media include a homepage, apps and social networks as well as wikis, podcasts, social blogs, video and image portals. With the help of these resources, a rapid exchange in crisis situations is possible. In this study, the individual social media are examined in comprehensive groups such as the homepage, the apps and the social networks. A homepage is created and optimized by the respective organizations themselves. On a homepage you can find information about the type of organization, the fields of activity as well as news. The function of a homepage is to show the presence of the organization to the population. The apps are mobile software applications that each concentrate on one content area. There are many apps on the market that deal with catastrophes, earthquakes, storms and epidemics and warn the population of catastrophes and crises [12]. Apps of this kind are based on the two options of either establishing bi-directional communication between the citizen and the authorities or linking information about incidents by collecting data about them centrally and using them publicly [13]. Last but not least, the use of social networks should be considered. So far, social networks have primarily served the private communication of the population. The basic paradigm of social networks is the communication within and between groups of people by using internet technologies. Thus, an Internet platform is used for this purpose. In a list of the twenty most visited websites in Germany, seven belong to social networks [14]. With such active use, it makes sense to use the social networks in crisis situations to communicate with the population. It should be borne in mind that from the diversity of social networks, those are suitable that fulfil the intended purpose.

2.1.4 Tasks. Once a crisis or catastrophic situation has arisen, the relief workers are dependent on a clear distribution and transparent execution of the security tasks. In order to react in time to a hazardous situation, relevant information must be quickly collected and forwarded to the responsible authorities. In this context, an optimal distribution of resources plays a very important role. When passing information in a situation with urgent need

for action it is both efficient and effective to distribute necessary and approved information from a public authority to many people in the population at the same time, called the one-to-many principle. In the event of a gradual crisis, the population can be prepared for the impending events with early information in advance [15]. During a crisis situation, however, the security forces may also have to perform other tasks, such as gathering information or feedback from the population, as the population helps in some cases. Therefore, the relief workers must recruit and organize the volunteers [16].

For all these tasks, means of communication can be used to help those involved. The use of different means of communication can also pose a risk if the public is interfering with the work of the security forces by making false reports. Unwanted content, such as contributions or photos, can be distributed uncontrolled by means of social media, which makes crisis management more difficult [15].

2.1.5 Goals. In order to cope successfully with a crisis situation, certain objectives must be met in communication within the public safety authorities and also externally with the population. Communication with the population must be clear and unambiguous. To achieve this clarity, there must be clear structures and transparent implementation of security tasks within the authorities. The public safety authorities depend on the trust of the population, for example to avoid the escalation of potentially dangerous situations in a crisis situation. They should therefore strengthen and maintain both the confidence and credibility of the population [17]. In order to achieve this objective, the press offices must make uniform information available to the public.

Successful de-escalation measures and their targeted implementation are based, on the one hand, on gaining the empathy of the population for the public safety authorities and, on the other hand, on building up a positive image through a successful performance. Successful communication in crisis situations is both - an important task and a goal for the entire public safety department [11].

2.2 Model of communication

In the context examined, several user groups interact with each other. They use different means of communication to fulfill common tasks and goals. For a smooth process, the communication level must be examined. For this reason, a communication model will be explained in the following, which shows interaction and communication problems between people and refers to the present case.

In the investigated case, communication between the relief workers and the population in crisis communication, theoretically different parties exist that communicate with each other. Let us assume that we have a clearly defined crisis area in which directly and indirectly affected persons are staying. These persons communicate with each other, be it first aid measures, exchange of information about the situation, warnings or even outside the danger area, in order to inform relatives and warn other persons. The relief workers arrive and communicate both with the directly and indirectly affected persons and with the relief workers outside the danger area in order to present the extent of the danger, to

request help and to inform persons outside the crisis area. Depending on the extent of the crisis, the communication methods are determined. If people can communicate directly with each other in a small crisis area, communication over longer distances already looks different. This may require the use of technical means. Basically, a pattern can be identified in which active and passive communication partners are recognizable.

In this context, the unidirectional Shannon Weaver model of communication is appropriate: At least two people communicate with each other. One active and at least one passive person. The active person, for example a firefighter, is called the source of the message. The agency wants to inform a large part of the population as well as the public relations agencies outside the crisis about the extent of the danger. To do this, he enters the message into his smartphone, referred to here as the transmitter, which is then coded. The message is then sent to the recipient via a communication channel, in this case an app, platform or social network. This message is sent to at least one device, the recipient. The message is decoded and thus made accessible to at least one target person. This type of transmission favors communication between one and many people, because one communication channel can provide many interfaces for end devices and one end device can be used by many people. However, the target person has no way of reacting to the message or processing it further. In addition, there are interfering factors between the persons, which can make communication more difficult depending on the means used. It can be an unclear pronunciation or inattention, an unknown language or dialect, but also technical disturbances during transmission and reception [18].

In the interaction of the actors, linear data transmission is not sufficient but requires an exchange of information. The direction of a linear transmission must therefore always change. This type of communication is used by the new media, which have return channels and thus enable bidirectional communication.

3 Methods

In the following, the procedure and methods of the study are first explained and then the hypotheses are discussed.

3.1 Method of procedure

The aim of the work is to obtain an accurate picture of the communication in crisis situations: Which of the listed means of communication are used, to what extent and for what purpose? In order to verify the context of use, two hypotheses have been proposed, which have to be verified by means of a survey among the representative user group. For the implementation of the survey, the platform called SoSci-Survey was used, which was carried out with the help of an online questionnaire. The survey participants had the opportunity to answer the questions that were asked during the period of two weeks from 26 June to 10 July 2015. For the participation in the survey 236 press offices of the police, fire brigade, rescue service and the city administration all over Germany were contacted. Of these, 86 records were incomplete and 32 completed.

In the data evaluation, the methods of descriptive statistics were applied, in which the frequencies occurring, the mean value, the standard deviation and the range were examined in order to subsequently determine the significance of the results.

3.2 Hypotheses

During literature research, no clear prioritization of certain means of communication by public security authorities could be identified. Thus, the first hypothesis focuses on the different types of communication media and their frequency of use: There is no difference between the public safety authorities with regard to the time spent per week on the means of communication: broadcasting, satellite radio, acoustic warning devices and the print media (H1).

Due to the fact that social media seems to play an increasing role, we additionally focused on the role of social media. However, from literature we could not deduce clear indications which public authorities would especially benefit from these new possibilities. As a consequence, the second hypothesis is: The frequency of social media use per week does not differ between the public safety authorities (H2).

In order to obtain as many results as possible and to create the same conditions for all participants, the study is carried out by means of an online survey. The survey was based on the means of communication mentioned in subchapter 2.1.3, which were compared between the police and the fire service in terms of use and aims.

4 Results

This section presents the results of the evaluation. First, we look at the demographic data, followed by the results of the communication behavior. Finally, the hypotheses are discussed.

4.1 Demographic data

The evaluation of the survey showed that 27 men and 5 women participated in the survey. The age of all survey participants is between 20-60 years. Most respondents (N=14) were between 40 and 50 years old. The youngest group includes two 20-30 years old and nine of the oldest respondents aged between 50-60 participated in the survey.

When asked about the origin of the survey participants, most of them stated that they came from North Rhine-Westphalia (N = 12) and Hessen (N = 7). Five of the survey participants claimed to work in Baden-Württemberg, three in Bavaria, two persons in Brandenburg and Schleswig-Holstein as well as one person in Saarland. Other federal states were not represented.

Most of the survey participants stated in equal parts that they came from the police and fire brigade with 14 persons each. Since the number of responses from the police and the fire brigade is the same, it makes sense to compare them with each other and to observe how the authorities use the means of communication. In the further course of the evaluation, the results of the police and fire brigade will be reported.

The positions of the respondents are distributed independently of the areas. Most of the questions asked by the police indicated

that they were press spokespersons, with one person working in press and one in public relations. In the case of the fire brigade, four people each stated that they worked as press officers, commanders or group leaders and in public relations. In each case one person stated to be employed with the press work and in the administration.

When asked about the length of employment, most respondents (N = 8) to the police stated that they worked in their position for 1-5 years. One person from the police indicated that he or she had worked in the position for another 5-10 years for less than one year. Only four people reported that they had been employed by the police for more than 10 years. From the fire department nine persons gave longer than 10 years, four persons 5 - 10 years and one participant 1 - 5 years to exercise their profession. We assumed that these results of work duration could suggest experiences in the profession. Finally, six people from the police and seven people from the fire brigade stated that they had had experience with crisis situations.

4.2 Communication behavior

4.2.1 Importance of goals. The other results relate to the main objectives of communication in crisis situations. The range of answers ranges from "not important" at all to "very important". The first goal, to create clarity in communication, is rated as very important by the survey participants on average by the police and the fire brigade. The survey participants from both parties consider it important for the public safety authorities to gain the empathy of the population. The goal of strengthening the confidence of the population was considered important by the police and fire brigade on average. Both parties, the police and the fire brigade, consider the development of the positive image of the authority to be important. The goal of maintaining transparency and clear structures in the implementation of security tasks in crisis situations was considered important by both the police and the fire brigade. The last goal is to avoid escalation, which is considered important by the police on average and very important by the fire brigade on average. For a better understanding, the results of the frequencies can be compared with those shown in Figure 1.

When asked about the amount of time spent preparing for crisis situations, 11 of the survey participants said that the police spent less than one hour a week and one person 3-5, 6-10 hours a week and more than 10 hours a week. 14 survey participants from the fire brigade stated that they spent less than one hour a week preparing for a crisis situation. When asked about the use of a crisis guide, all respondents asked the police to use a guide produced within the agency. Nine survey participants from the fire brigade used an internal guide and two users used an external guide, which can be viewed by the public. Three other respondents stated that they did not use a crisis guide.
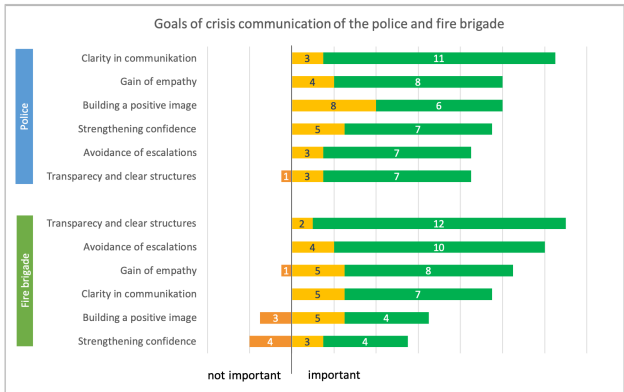

Figure 1: Goals of crisis communication of police and fire brigade.

4.2.2 Use and frequency of use. In the following, the use of the means of communication by the target group and their frequency will be discussed. The results of the survey are listed below in groups and the individual means of communication. The frequency of use takes place in hours per week. The frequency distribution contains four steps: less than one hour, two to four hours, five to seven hours and more than seven hours per week. The frequencies of use are compared in Figure 2 below as an overall view of all the communication media listed so far. Twelve respondents from the police and thirteen respondents from the fire brigade stated that they used radio for the first group of radio users. Ten survey participants from the police and nine from the fire brigade use television to communicate with the population.

	Times per week								SUM		
	< 1		2-4		5-7		> 7				
Broadcasting	4	10	4	3	2	--	3	--	13	13	26
Satellite broadcasting	8	2	1	--	1	--		--	10	2	12
Acoustic warning devices	7	11	--	--	--	--	--	--	7	11	18
Print media	2	6	3	2	3	1	6	1	14	10	24
Homepage	5	2	3	4	2	4	--	2	10	12	22
Apps	3	4	--	1	--	--	--	--	3	5	8
Social network	1	2	1	4	3	2	--	1	5	9	14
SUM	30	37	12	14	11	7	9	4	62	62	124

Police　Fire department

Figure 2: Overview of the frequency of use of means of communication by person.

The results on the use of the satellite broadcasting were as follows. Seven of the police and three of the fire brigade respondents provided the information phone in crisis situations and three respondents from both authorities provided the local number. The emergency fax is used by one person at the fire brigade and the satellite-based early warning system is used by one person at the police. Three police officers and one firefighter stated that they used SMS as a means of communication in crisis situations. The evaluation of the questionnaire also showed that, of the acoustic warning devices, the loudspeaker trucks with eleven persons are

most frequently used by the fire brigade and six persons by the police. This was followed by the widespread use of sirens with nine users by the fire brigade and the mobile warning vehicle with a total of seven users (3 = police, 4 = fire brigade). In the print category, thirteen respondents from the police and nine from the fire brigade declared that they use the daily newspaper in crisis situations. Six participants from the police and four from the fire brigade, on the other hand, use flyers. Results from magazines and the yellow press were not published.

When asked about a homepage as a means of communication, ten participants of the police and twelve survey participants of the fire brigade agreed to its use. The next question contains results of the knowledge and the use of mobile Apps. A police participant informed about the following apps: Composite, CMAS, Disaster Alert, Ushaidi. Two further apps each announced that they knew the apps deNIS and Disaster Radar. The apps EQInfo, "Krisenkompas" and KATWARN each know three people. Eight people have stated that they know LÜKEX 13 and that the use of these apps could not be recorded.

In the Social Networks category, four respondents asked the police and eight the fire department to use Facebook for crisis communication. Three police respondents and six firefighters agreed to use Twitter. Only two of the fire department respondents said they would use the Youtube-platform as a means of communication in crisis situations. No other means of communication were recorded.

4.2.3 Purpose of the means of communication. The results for the intended use of the means of communication are listed below and visualized in diagrams for better understanding. For the better overview, the first most important means of communication are listed for each purpose. A mean value was calculated from the results so that the most frequently used means can be identified and presented. A total of ten objectives were presented to the respondents, which they should relate to seven means of communication according to their importance. In this way, the tendency can be identified as to which means of communication the survey participants use for which purpose in crisis situations. The range is five points and ranges from 1 = "not important" at all to 5 = "very important".

For the accessibility of a large part of the population in crisis situations, the police considers broadcasting $(M_{N=13} = 4.54, SD = 0.66, Range = 3-5)$ and print media $(M_{N=13} = 4.54, SD = 0.66, Range = 3-5)$ to be very important and acoustic warning devices $(M_{N=7} = 4.29, SD = 0.95, Range = 3-5)$ to be important. The fire brigade considers the use of broadcast $(M_{N=12} = 4.33, SD = 0.78, Range = 3-5)$ and print media $(M_{N=9} = 4.22, SD = 0.97, Range = 3-5)$ for this purpose to be important and the acoustic warning device $(M_{N=12} = 4.5, SD = 0.80, Range = 3-5)$ to be very important. The results shown in Figure 3: One-to-may-Principle are shown below.

In order to receive feedback from the population, the police consider the homepage $(M_{N=10} = 3.60, SD = 1.43, Range = 1-5)$, the social networks $(M_{N=5} = 4.20, SD = 1.79, Range = 1-5)$ and the print media $(M_{N=13} = 3.62, SD = 1.12, Range = 1-5)$ to be important on average.
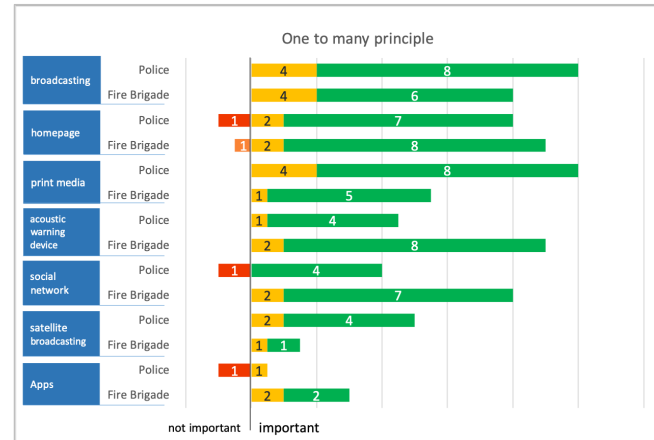

Figure 3: Use of means of communication by the police and fire brigade to reach large crowds of people.

The fire brigade considers the use of the homepage $(M_{N=12} = 4.42, SD = 0.90, Range = 2-5)$ and the print media $(M_{N=8} = 3.50, SD = 0.93, Range = 2-5)$ to be important and the use of the social media $(M_{N=9} = 4.67, SD = 0.50, Range = 4-5)$ to be very important. The complete values can be taken from Figure 4: Use of police and fire brigade media for bidirectional communication.
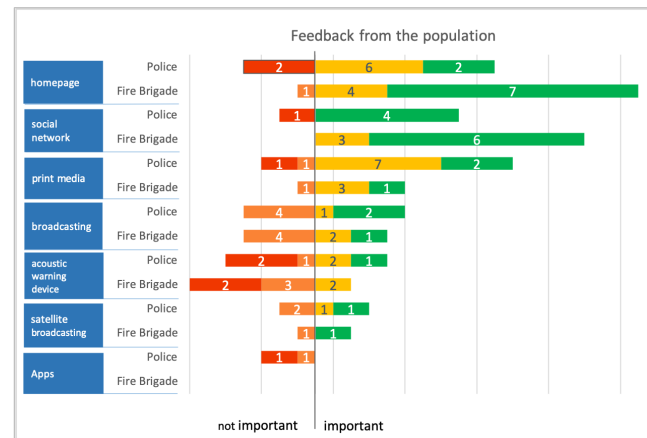

Figure 4: Use of police and fire brigade media for bidirectional communication.

With early information about a situation, it is possible to adapt one's own environment and well-being to the situation. The fire brigade considers the social media to be of average importance for early information $(M_{N=9} = 4.78, SD = 0.44, Range = 4-5)$. The police consider the use of social networks to be of average importance $(M_{N=5} = 3.80, SD = 1.79, Range = 1-5)$. The radio is considered important by the police $(M_{N=13} = 4.23, SD = 0.83, Range = 3-5)$ and very important by the fire brigade $(M_{N=12} = 4.58, SD = 0.67, Range = 3-5)$. Both the police $(M_{N=13} = 4.38, SD = 0.96, Range = 2-5)$ and the fire brigade $(M_{N=8} = 4.13, SD = 1.13, Range = 2-5)$ consider the print media to be of average importance. The complete values can be taken from Figure 5.
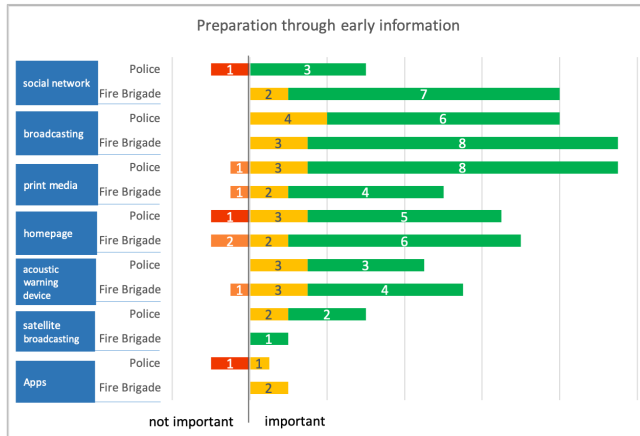
Figure 5: Use of police and fire brigade media for early information.

For the purpose of self-help of the population, the protection forces make information available to the public. The fire brigade considers the social networks $(M_{N=9} = 4.67, SD = 0.71, Range = 3-5)$ and satellite radio $(M_{N=2} = 4.50, SD = 0.71, Range = 4-5)$ to be very important and the print media $(M_{N=8} = 4.25, SD = 0.89, Range = 3-5)$ to be important. In comparison, the police rate the use of the communication media mentioned as neutral on average. The complete values can be taken from Figure 6.
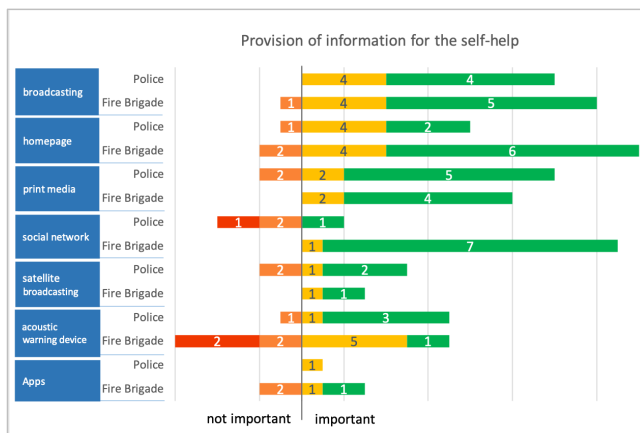

Figure 6: Use of police and fire brigade media to increase self-help among the population.

The fire brigade would consider the satellite radio $(M_{N=2} = 4.50, SD = 0.71, range = 4-5)$ to be very important for the participation of the population in crisis management; the social networks $(M_{N=9} = 4.33, SD = 0.87, range = 3-5)$ and the homepage $(M_{N=12} = 3.75, SD = 1.36, range = 1-5)$ were rated as important. On average, the police rated all available means of communication as neutral for this purpose. The complete values can be taken from Figure 7.
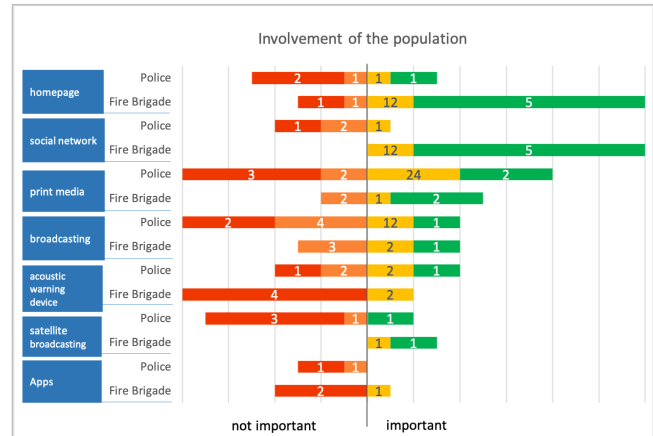

Figure 7: Involvement of the population in crisis situations

The fire brigade considers satellite radio $(M_{N=2} = 4, SD = 1.41, range = 3-5)$, the homepage $(M_{N=12} = 3.92, SD = 1.38, range = 1-5)$ and the print media $(M_{N=9} = 3.78, SD = 1.09, range = 2-5)$ to be important means of communication for the organization and recruitment of volunteers. On average, the police rated all available means of communication as neutral for this purpose. The complete values can be taken from Figure 8.

For the use of social networks as a source of information for photos $(M_{N=9} = 4.67, SD = 0.71, Range = 3-5)$, the fire brigade rated them as very important on average. As a source of information for messages $(M_{N=9} = 4.44, SD = 0.88, Range = 3-5)$ and videos $(M_{N=9} = 4.33, SD = 1.12, Range = 2-5)$, the social networks were rated as important. The police consider the social networks to be important for the use as a source of information for news $(M_{N=5} = 4, SD = 1.73, Range = 1-5)$. The social networks were rated as neutral by the police for the purchase of photos and videos. The values are visualized in Figure 9.
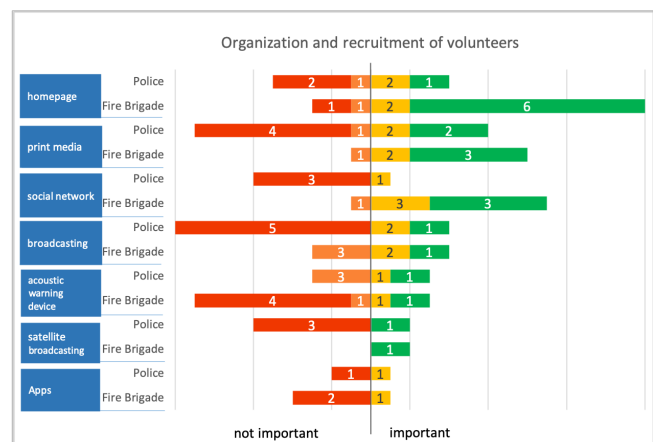

Figure 8: Commitment to the organization and recruitment of volunteers.
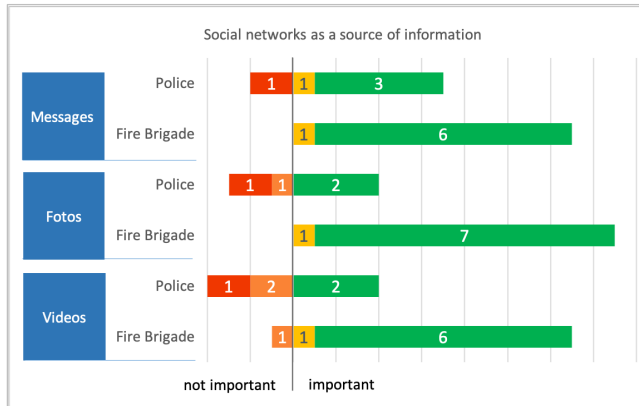
Figure 9: Use of social networks as sources of information.

According to the fire brigade, the use of the social networks *(M$_{N=9}$ = 3.78, SD = 1.30, Range = 1-5)* and the homepage *(M$_{N=12}$ = 3.5, SD = 1.62, Range = 1-5)* is likely to impair work due to false reports by the population. When using apps, the fire brigade takes a neutral view of the danger of false alarms. The police probably consider the danger to be neutral for all three means of communication. The results can be seen in the following Figure 10.
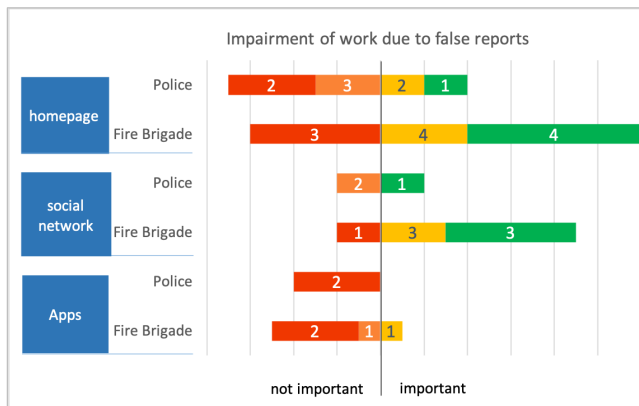

Figure 10: Impairment of work due to false reports of the population.

4.3 Validation of hypotheses

The significance of the hypotheses has been tested on the basis of the values collected. The comparison of the results and the subsequent execution of the Chi-square test showed that the frequency of use only differs significantly (alpha = 0.05) with regard to one means of communication between the police and the fire brigade: The study revealed that satellite radio is used significantly more intensely by the police than by the fire brigade. The evaluation of the results in relation to the second hypothesis showed that the frequency of use of the new media does not differ between the police and the fire brigade. Although many authorities have been contacted during the preparation of the study, the number of survey participants was quite low (N = 32). Thus, this might be reason for the limited amount of significant differences.

5 Discussion

A closer look at the target groups of this work, the police and the fire brigade, reveals that the use of communication media differs on average. However, both authorities predominantly use classical means of communication in crisis situations. According to their own data, the majority of police respondents mainly use the daily newspaper, whereas the majority of fire brigade respondents mainly use loudspeakers or sirens.

5.1 Interpretation

The use of different means of communication could be due to the different requirements of the function and tasks of these authorities. If the police inform the public about events or investigations, then the daily newspaper meets these requirements. The fire brigade communicates with the population mainly in emergency situations and large-scale events where a large number of the population must be warned. This interaction, consisting of a portion of information and feedback, usually takes place on site. Therefore, sirens and loudspeaker cars can be used to inform the population and at the same time observe how they behave.

Furthermore, differences in the choice of means of communication could be observed in the age and length of working hours of the respondents. The preference for classical means of communication could be traced back to a tradition, because most of the respondents are between 40 and 60 years old. It is obvious that means of communication that have been used over a long period of time and with which good experiences have been made are also used in crisis situations.

However, if the data on the means of communication used are compared without dividing up the target group, it can be seen that broadcasting is the most commonly used by traditional means. According to statistics, television is one of the media most used by consumers in Germany and is watched by German consumers for 225 minutes a day. Radio is a medium used by 77% of the population, with a decrease of 11.1% since 2001 [19].

The daily newspaper is a means of communication with a high usage rate. However, according to statistical data, sales figures in Germany are declining here as well. Instead, more and more information is being drawn from a digital solution, the e-paper. Observations show that newspapers or magazines are constantly purchased via mobile devices [20]. Acoustic warning devices are often used to warn the population in an emergency. This means of communication is used in combination with the radio. One advantage of this means of communication is its ability to address large populations. Unfortunately, the biggest problem is that most citizens are [21] neither aware of the differences in siren tones nor feel addressed by the sirens [22].

Since the shutdown of the conversion from mechanical to electronic sirens in 1992, the siren network has been dismantled or no longer maintained. For this purpose, each federal state could determine its own siren tones. It is therefore understandable that citizens neither know the significance of the alarms nor assume that they are dangerous. Citizens must be sensitized first and foremost to the significance and understanding of the siren tones [23]. According to the evaluation, the only new means of communication intensively used is the homepage.

The majority of respondents said that the use of traditional means of communication in crises can be due to the fact that the use of new media is hampered by technical circumstances, such as insufficient network coverage. The positioning of the satellites is not yet such that network coverage throughout Germany is flawless and of the highest standard. There are still a few areas in some federal states that still do not have good reception [19].

Even if the direct indication of the parties involved points to classical means of communication, it becomes clear when comparing the tasks and the purposes of use that the respondents use the new media more often on average. The evaluation has shown that the most important of the relief workers is the radio, followed by the print media and acoustic warning devices to reach large populations. These means of communication can be used unidirectionally.

Since Web 2.0, communication no longer runs from a few transmitters to many receivers, but empowers passive media consumers to take over the active part. With its communication behavior, the auditorium determines the content and the time at which it should be read, heard or seen. Due to the lack of interactivity of classical media such as newspapers and radio, they have to compete for the attention of users against new media such as social networks and their reach. The public is no longer satisfied with the monologue from press releases, but rather calls on companies and organizations to engage in dialogue. Questions and criticism are expected to be answered quickly, transparently, individually and comprehensibly. Any deviation or even refusal of dialogue can cause a digital and uncontrolled wave of indignation. Although this rarely has long-term consequences, it does mean a shift in power [24]. The distribution of the evaluation is relatively balanced for this purpose and between the police and the fire brigade.

In order to receive feedback from the population, the survey participants considered the homepage and social networks to be the most important on average. The users' need for communication can be very positive if the population is positively involved in crisis management and provides the relief workers with valuable information. Eyewitnesses record events and impressions with their mobile devices and share them with other users. The relief workers thus have valuable information at their disposal that allows them to gain insight into the real-time situation that they would not have obtained via the traditional route. This purpose is well suited to the use of new media. The distribution between the police and the fire brigade is similar.

In providing early information to the population, the majority of firefighters used social media, equal shares of radio and the majority of police used print media. In order to provide the population with information for self-help and to involve them in the crisis management process, the fire brigade mainly uses social networks. In the police results, there is at least one "not important" rating for each of the means of communication. From this it can be concluded that this purpose does not correspond to the requirements of the police.

During a crisis, Web 2.0 requires a skillful communication strategy. If the authorities interrupt the communication, the communication can be continued by the population through subjective interpretations. In a crisis, silence can be understood as incompetence and spread. Both result in a loss of trust [24].

In order to win the trust, the population should be involved in the events in a controlled manner. For this purpose, satellite broadcasting was considered the most important, followed by the social media and the homepage. With these means the population has the possibility to interactively deal with the events. The transparency of information and a better communication are promoted by it, which increase the credibility.

Confidence of the population contributes to the essential success of the crisis fight. As the scale of the crisis increases and the confidence of the population decreases, situations can escalate. Measures, on the other hand, must be discussed honestly about the causes, effects and consequences. Public discussion and prevention can prevent escalation. Prevention includes the establishment and maintenance of media networks as well as the planning and production of information materials [24].

On the basis of the available results, it can be seen that the fire brigade is more open to the use of social media to obtain photos, news and videos of the population than the police.

The course of crisis management can be greatly influenced by certain actions and reactions immediately after the onset of the crisis. In this view, the focus is on public relations work. This has the power to keep external communication under control and to leave no room for false reports or rumors [24].

On average, both the police and the fire brigade are the most likely to believe that a work disruption can be caused by false alarms from social networks. They consider the damage caused by the homepage and the use of apps the least likely.

Even if the usage rate of the new media is not very high, they are already being used successfully in crisis situations. Examples of this are the floods in Germany in 2013 or the earthquake in Haiti, in which spontaneous helpers organized themselves and coordinated the relief actions via the social media channels [24].

5.2 Conclusion

We have noticed that at first glance the usage rate of new media was lower than that of traditional media. This result seemed surprising at first, as the consumption of digital communication is increasing more and more. According to a study conducted at the end of 2017 with 1,000 participants aged 14-69, the use of traditional media in everyday life is steadily declining. By contrast, there has been an increase in the use of a smartphone. In particular, the average useful life of social media is between 71 and 80 minutes per day. Facebook followed by Twitter are the pioneers [25].

Apart from everyday use in a normal state, the successful use of social media in crisis situations has already been observed. Examples are the floods in Germany in 2013 or the earthquake in Haiti, where spontaneous helpers organized themselves and coordinated the relief actions via the social media channels [26].

Overall, we found that the respondents gave different and sometimes contradictory information on the use of the means of communication. This can happen if a user thinks outside of this

context. To verify this information, a further contextual and comprehensive evaluation would be useful.

In conclusion, we found that to fully consider the scenario, all target audiences must be involved. It is somewhat difficult to create an authentic context environment for a crisis situation for evaluation purposes. However, the survey participants can be introduced to the scenario through certain questions, so that he or she can put himself or herself as well as possible into the desired situation. As already mentioned, the target group population determines the type of communication and the means of communication as a communication partner. Therefore, the involvement of representative users is indispensable for a complete presentation of the interaction and the means of communication used.

If this data is available, the interaction between the public safety authorities and the population in crisis situations can be reconstructed and the means of communication used can be identified with a higher probability.

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