

# XHELP: Design of a Cross-Platform Social-Media Application to Support Volunteer Moderators in Disasters

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## ABSTRACT

Recent disasters have shown an increase in the significance of social media for both affected citizens and volunteers alike in the coordination of information and organization of relief activities, often independently of and in addition to the official emergency response. Existing research mainly focuses on the way in which individual platforms are used by volunteers in response to disasters. This paper examines the use of social media during the European Floods of 2013 and proposes a novel cross-social-media application for volunteers. Besides comprehensive analysis of volunteer communities, interviews were conducted with “digital volunteers” such as Facebook moderators of disaster-related groups. Based on the challenges identified, we designed and implemented the cross-social-media application “XHELP”, which allows information to be both, acquired and distributed cross-media and cross-channel. The evaluation with 20 users leads to further design requirements for applications aiming to support volunteer moderators during disasters.

## Author Keywords

Social Media; Emergency Management; Digital Volunteers, Cross-Platform, European Floods, Design Case Study

## ACM Classification Keywords

H.5.3 Group and Organization Interfaces.

## INTRODUCTION

Social media can be described as a “group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content” [17]. Salient examples include Facebook with about 1.35 billion active users monthly, and the microblogging platform Twitter numbering approximately 284 million active users monthly. The functionalities they offer are demonstrably suitable to support communication and coordination between the people affected by and volunteers helping during emergencies. They enable real and virtual help activities to be addressed

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[30, 49] although some limitations have also been recognized [11]. Their emergent relationship with official responders has also been well-attested [47]. Social media have been extensively used during various disasters, such as the 2010 Haiti earthquake [44, 49] or 2012 hurricane Sandy [16]. The 2013 European floods are one of the latest examples [10]. During the flood, not only did a great number of professionals engage in building up flood barriers but volunteers and the people affected by the floods participated too. In situations where the scale and extent of difficulties are emergent and therefore not completely known; or where resources may be scarce or inappropriately allocated; and where information unfolds rapidly, the role of unofficial actors can be critical.

This design case study [48] aims to examine how real and virtual relief activities might be supported by specific tools. These activities are initiated and coordinated through the use of social media. Based on a review of related work, which helped us frame some of the relevant questions, we conducted an empirical study concerned with the role of volunteers and use of social media during the 2013 European floods. This was accomplished by analyzing content from social media as well as conducting interviews with “digital volunteers”. Challenges were identified based on this study and an attempt was made to address these challenges by means of XHELP, our cross-social-media application for volunteers in emergencies, especially for moderators of emerging groups. We finally evaluated XHELP with 20 users.

## RELATED WORK: VOLUNTEERS AND SOCIAL MEDIA

### Digital and Real Volunteers in Emergencies

Substantial, organized volunteering during disasters is not a novel phenomenon: Nearly 40 years ago, these “emergent groups” were characterized as “private citizens who work together in pursuit of collective goals relevant to actual or potential disasters but whose organization has not yet become institutionalized” [36]. According to Quarantelli [28], the essential conditions for their emergence are (a) a legitimizing social environment, (b) a perceived threat, (c) a supporting social climate, (d) a network of social relationships, and (e) the availability of specific (immaterial) resources. The broad acceptance of social media has, however, widened the possibility for crisis communication from authorities to citizens as well as the coordination of voluntary activities [31]. Reuter et al. [30] distinguish between activities in the “real” and the “virtual” world. A distinction

becomes apparent between real “emergent groups” [36], which usually act in the form of neighborly help and on-site work, and virtual “digital volunteers” [37], who originate from the Internet and work online. Accordingly, one of the main challenges is to combine these communities.

### Volunteers and Social Media

The emergence of digital volunteers and “voluntweeters” [37] (digital volunteers in the Twitter sphere) and their use of social media has been studied in the context of various disasters: Users organize and disseminate crisis-related information [13], seek information about peoples’ status [27], express solidarity [38] or coordinate both material and immaterial resources [25]. Starbird & Palen [37] suggested that personal relationships with people affected and the pure desire to help were the initial reasons for using Twitter. The prospect of *identifying, amplifying and redirecting information* was examined in multiple studies, which highlight the role of retweeting, outline the phenomena of information *broadcasting* or information processing through filtering [38]. Another important aspect is the *verification* of information as there are obvious issues with regard to the perceived credibility of social media content in comparison with other media. Information with no clear source, for instance, can be implicated in the spread of rumor [23]. Even so, activities of *structuring and synthesizing* become apparent [45]. These studies analyzed how Twitter can contribute to the production of an overall, coherent picture which enables an appropriate response to the developing situation [29], and indicates that tweets including situational updates or geolocations are more likely to be retweeted than others. Volunteer role classifications include “helper”, “reporter”, “retweeter”, “repeater” and “reader” [30] as well as “information broker”, gathering and reporting information [46]. Kaufhold & Reuter [18] suggest “moderators”, who establishes supportive platforms for real and virtual activities, mediates offers of and requests for assistance, mobilizes resources and integrates information of various sources.

### Volunteers – Potentials and Obstacles

Digital volunteerism, then, might have both positive and negative consequences. Many studies highlight the “chaotic” or disorganized work of volunteers [4, 44], whose activities are indisputably valuable, but which also often lead to confusion. Activities in danger-zones have the potential to increase not only the complexity of tasks but also uncertainty and the pressure on emergency services, especially if the volunteers themselves are endangered [25]. Valecha et al. [44] suggest that “whenever there is greater uncertainty reduction needed, there will be a larger amount of collaboration on the platform”, while uncertainty can be generated by redundant information and mistakes due to the chaotic “disorganized” work of volunteers. Accordingly, Chen et al. [4] describe the actions taken by the emergency services to correct the mistakes caused by the “emerging risks of the chaotic use of social media”. Another suggested remedy lies with so-called “community scouts” [31]. In one case, a

group of “trusted volunteers” was respectively formed to monitor social media and transfer “semi-official” reports to officials [7]. Different social media entail different forms of communication [16]. Nevertheless, most studies focus on the use of Twitter, perhaps due to the ease of data access or the frequency of use [31]. However in many European countries such as Germany – where our study pertaining to the European floods was conducted – 56% of all Internet users actively use Facebook, whereas the active usage of Twitter is significantly lower at just 6% [2]. Yet, Birkbak [1] claims to be one of the first comparative case studies of public Facebook groups in emergencies, showing that more research is needed. The use of more “closed” social media creates new design requirements, e.g. to make them more listenable. Thus, “data showed that replies by emergency managers to questions from the public were often buried within response threads to individual messages” [16]. They suggest that, “to make online media streams more “listenable” for on-the-ground emergency managers, new [...] tools are needed that allow emergency managers to better track, respond to, and document public information”.

Research efforts have been largely geared to identify as design requirements. Reuter et al. [30] propose, (a) the integration of ICT for volunteers into existing networks, (b) the fostering of voluntary groups coming into existence, (c) connection between virtual and real activities, and (d) interfaces with official crisis management. Furthermore, based on interviews with emergency services and digital volunteers, Cobb et al. [5] suggest (a) the coordination and integration of voluntary activities, (b) the connection between different tools and tasks as well as (c) the option to share their own activities in order to generate learning effects for spontaneous and often less experienced volunteers. They argue to query multiple social networks with filter options.

### Existing Approaches and Tools

A number of public, scientific or commercial applications have been developed for coping with social media [26]. They are being directly or indirectly developed for crisis management, but have limitations, as will be explained in the following. They have (a) syntactical requirements, (b) do not support cross-media communication, or (c) are not integrated in networks users are familiar with (Table 1).

Tool and Reference	a	b	c	Tool and Reference	a	b	c
Brandwatch [3]			x	Tweak the Tweet [39]	x	x	
Geofeedia [12]			x	TweetDeck [42]		x	x
Hands2Help [14]	x	x	x	Twitcident [40]		x	x
HierarchicalTopics [9]			x	TwitInfo [20]		x	x
Hootsuite [15]			x	UberMetrics [43]			x
SensePlace2 [34]		x	x	Ushahidi [24]		x	x
Sproutsocial [35]			x	Visual Backchannel [8]		x	x

Table 1: Several existing Approaches and Tools

*TweetDeck* [42] is a publicly available tool for real-time tracking, organizing, and engagement. It enables Tweet publication, management, and search (based on quantitative criteria). Multiple approaches aim to provide visualization

which supplements the common activity- or list-based view of social media. For instance, *Visual Backchannel* [8] offers a multi-faceted visual overview enriching queried tweets with a temporal topic stream, a spiral of involved people, and an image cloud. *TwitInfo* [20] additionally presents a message frequency graph and evaluates the overall positive and negative sentiment of the analyzed set of tweets in a pie chart. *HierarchicalTopics* [9] is an approach to visually exploring large text collections; however, the system is not customized for citizens. Other platforms concentrate on the map-based visualization of data: *Ushahidi* [24] is a platform for the collection and visualization of information and interactive mapping. Supporting multiple data streams, e.g. text messages via smartphone app, email, Twitter, and web forms, it allows the dissemination of reports which can be displayed via list or geo-reference in a map view. Similar to *SensePlace2* [34], Ushahidi enables the chronological filtering of messages. The downside of Ushahidi is, however, that it requires the deployment of a separate platform, while SensePlace2 is not publicly available. Although a closed system, *Hands2Help* [14] is a mobile app concept which intends to coordinate volunteers in terms of supply and demand of help, enabling ad hoc registration and allowing efficient allocation and monitoring. An exceptional solution is the *Tweak the Tweet* [39] micro syntax for Twitter, allowing the automatic classification of information by means of specific hashtags and tweet structure. It is the only approach which is integrated in an existing network, but has syntactical requirements and is limited to Twitter.

Furthermore, there are plenty of commercial platforms providing cross-media functionalities: Hootsuite, Sproutsocial, *Brandwatch* [3], *Twitcident* and *UberMetrics* [43]. Each supports the monitoring, filtering and analysis of various social media utilizing a dashboard feature. However, these dashboard reports and visualizations focus on categories such as business performance, competitor benchmarking, and brand analytics. Using dashboards for volunteer activities therefore requires the identification of relevant information categories. Additionally, *Geofeedia* [12] focuses on the monitoring of specific and configurable geographic locations. In addition to the presented functionalities, *Hootsuite* [15] and *Sproutsocial* [35] both provide message publication and scheduling for public engagement as well as a team collaboration module which, for instance, allows the setup of permissions and roles, additional to the assignment and management of tasks. Moreover, *Twitcident* [40], which addresses emergency services, contributes the functionalities of event and incident detection. In conclusion, these approaches provide the aspect of dashboards, geographic monitoring, bidirectional message publication and task management. This could all be useful in supporting volunteer activities, but as commercial B2B products they are not available to a broad audience and do not address all requirements for volunteer moderators.

To summarize, almost all approaches (Table 1) have limitations when used by volunteer moderators in disasters: They either demand syntactical requirements from the user [39]; do not provide cross-platform structures, e.g. focus solely on Twitter [8, 20, 24, 34, 40, 42], or require the use of a new platform and therefore fail to integrate ICT for volunteers into existing networks (almost all).

### State of Play

Despite the outlined design requirements mentioned above, there is little existing research which focuses on the development of technical artifacts to support the rich coordination activities of digital volunteers - especially how to support the “community scouts” [31] or “trusted volunteers” [7] who appear in the form of very active “moderators” [18] during crises. Thus our design case study seeks to enhance the state of the art by providing a cross-social-media case study based on the 2013 European floods in order to derive challenges, which in turn inform the design, development and evaluation of a technical artefact to support the current practices of volunteers in disasters and “to make online media streams more ‘listenable’” [16].

### THE STUDY CASE: EUROPEAN FLOODS 2013

The European floods in June 2013 were an event in which self-help activities played a major role. 35 federal states of seven European countries had to declare a state of disaster in multiple districts; including 55 districts in Germany, notably the Federal States of Bavaria, Saxony and Saxony-Anhalt. This disaster caused the deaths of eight people in Germany and cost the states an estimated 6.7 billion Euro. The German armed forces (19,000 soldiers) and fire services (75,000 firefighters) participated in the relief efforts. The German Red Cross and further relief organizations were involved in medical care. Besides the large number of professional forces and voluntary organizations, many volunteers and affected people participated in building up flood barriers, filling and piling up sandbags, donating work material and goods for victims, distributing food and providing emergency shelters. The use of social media in this case has been acknowledged and even utilized by the traditional media. Volunteer activities were planned and coordinated, emotional support was given and eyewitness reports were shared. Using this case, Fuchs et al. [10] confirm the potential of Twitter as a distributed “social sensor”.

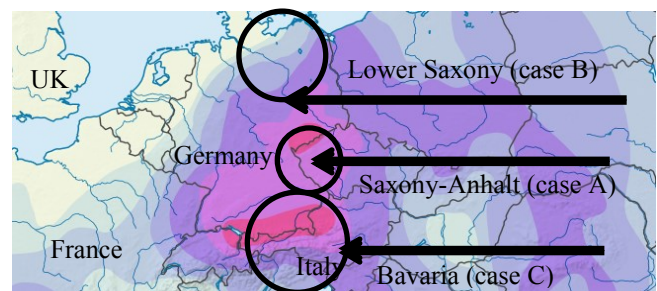


Figure 1: Amount of Rainfall and Cases during the Floods

### EMPIRICAL STUDY: USE OF SOCIAL MEDIA DURING THE EUROPEAN FLOODS IN GERMANY 2013

Our empirical study, which has partly been reported [18], aims to examine the usage of social media for the coordination of volunteer relief activities. In the period from June 6<sup>th</sup> to June 27<sup>th</sup> 2013, nearly 80,000 tweets containing the term or hashtag “hochwasser” (English: flood) were archived with the tool “Tweet Archivist Desktop”. We used the term “hochwasser” because it was listed among the top trends in Twitter and was mentioned in several media. Facebook group and page activities were downloaded as complete HTML docs. Additionally, news articles in the context of the floods were archived as PDFs and more than 50 screenshots were saved in order to document the use of Google Maps in the affected areas.

Our Twitter analysis focused on how and in what ways relief activities are shaped in and by Twitter. In doing so, we also looked at other related technologies. The Facebook analysis explored messages in three groups from three federal states in order to analyze processes regarding interaction, structuring, and task sharing (Figure 1, Table 2). In the third step of our empirical study we conducted phone interviews with moderators of the analyzed groups to gain insights into their work practices, ways of mobilizing resources [25] and self-organization processes [37] as well as identifying the potential for supporting them (Table 2). The interviews were designed to specifically address our interests. At the beginning, the interviewees were asked whether they belonged to an organization of civil protection or had competencies regarding professional crisis response. The subsequent part focused on the tasks and activities of the respondents; here, we were particularly interested in the relationship between online or virtual activity and mobilization 'on the ground'. The third part concentrated on task-sharing processes, during which the potential cooperation with emergency services was discussed. Finally the interviews posed questions at an ICT level by evaluating FB functions and discussing technical support potential.

Case/State	A: Saxony-Anhalt	B: Lower Saxony	C: Bavaria
Facebook Pages	Hochwassernews Magdeburg ( <i>Flood News Magdeburg</i> )	Hochwasser Niedersachsen ( <i>Flood Lower Saxony</i> )	Infoseite-Hochwasser Bayern 2013 ( <i>Infopage Flood Bavaria</i> )
Facebook Groups	Hochwasser Magdeburg – HilfsGESUCHE ( <i>Flood Magdeburg – Requests for help</i> )	Hochwasser Niedersachsen - BIETE/ SUCHE ( <i>Flood Lower Saxony Offer/ Search</i> )	Mamas Helfen ( <i>Moms help</i> )
Interviews	A (moderator)	B (moderator)	C (moderator)

Table 2: Empirical Study in Facebook

Although Twitter was extensively used in flood situations for distributing information and situational updates, our results show that it tended to mainly take the form of a broadcast medium for shaping cross-platform structures and extending coverage. The coordination of relief activities was rarely observed in the Twitter sphere alone, but took place within a complex ecology of both online and offline facilities. This could, to some extent, be a corollary of low Twitter penetration in Germany, but it is consistent with

Hughes et al. [16] showing differences of use across media platforms. Accordingly Twitter is used for real-time notification, and FB for community engagement [6]. In our case, local and subject-specific groups emerged on FB, which cooperated extensively with other groups/pages. These observations lead to our design challenges:

First, *clarity and representation of relevant content*: The issue of “collective activity”, so that all participants, officials and volunteers can access accurate and up-to-date information, can be supported by the identification or the assessment of information through search and filter functions. The interviews indicate that information tends to be sorted thematically with the aid of files. Additional functions for organizing information with search and filter options especially with geographical references are desirable. The purpose of such functions would be to render relevant help requests more available and listenable [16] to the users, to maintain a clear overview within the interaction platform and to support the interaction between moderators, helpers and people in need. These people are currently organized in different groups and use a variety of pages - and sometimes several pages - to articulate their demands.

Second, *moderation and autonomous work*: Interviews show that the moderator’s role (an extension of the Reuter et al. [30] role model) is to mediate demands, requests and offers for help; to mobilize volunteers as well as material and immaterial resources and to integrate information from media, official authorities and other organizations. This is evidently a serious role and entails considerable overhead. It is noticeable that private rooms are sometimes used for coordination, especially when privacy is of importance or sensitive data needs to be available on a limited basis. It is obvious that moderating a group is a very time-consuming process. ICT could reduce the amount of moderation activities by fostering the self-regulation of the participants.

Third, *feedback and updates in interaction relationships*: Incoming messages from people not appearing on one’s friends list are not flagged and are filtered into the residual FB folder “other”. This process impedes the giving of timely feedback. Regarding Google Maps, the requirements for up-to-datedness of geo-referenced objects could, in addition, be supported by notifications or time-based filtering.

Fourth, *integration of technologies and interaction types*: It is apparent that, in a complex ecology, different tools are used for different purposes. Twitter is particularly used for distributing situational updates. Interviewees saw the benefit of an embedded FB application as long as it is quickly accessible and fills feature gaps. Using maps such as Google Maps could also tighten the connection between real and virtual volunteer activities. When integrating these services, additional accounts should be avoided because not every user has accounts on networks such as Twitter or Google+. It should be remembered that not everyone is equally “savvy”; imposing an unnecessary learning overhead during a crisis situation is not to be recommended.

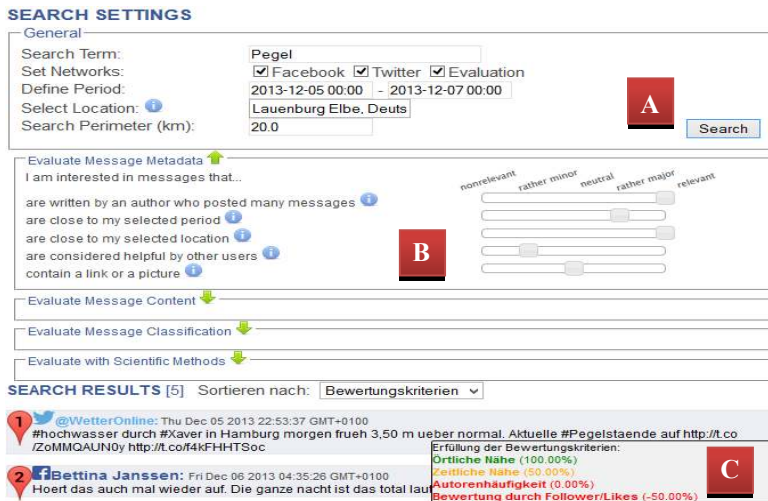


Figure 2: Search settings and results

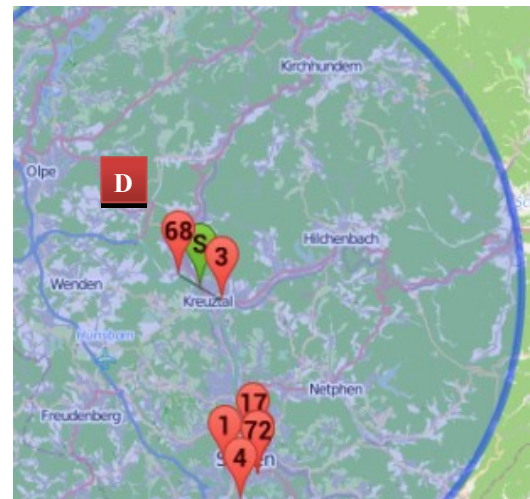


Figure 3: Geo-localization

**XHELP: DEVELOPMENT OF A CROSS-SOCIAL-MEDIA APPLICATION FOR VOLUNTEERS**

We developed the platform XHELP in order to support these requirements and with the overall aim of supporting the role of group moderator through functionality for assessing and distributing information. We are aware that such functionalities might also be of interest to other target groups. However, based on our research, volunteer moderators are our main target group so far. A cross-platform search and posting function should simplify the current practices and reduce organizational efforts. Since most of the relief activities we saw were organized via FB groups and pages, XHELP has been implemented as an embedded FB application. The advantages of such an approach are that an additional registration process is not necessary and potential entry barriers will be reduced. To evaluate the potential synergy effects of integrating several social networks, the functions of the web application will not just relate to FB, but will also integrate Twitter. Besides using XHELP inside FB, the user can also assess XHELP as an ordinary web version.

**Cross-Social-Media Search and Filter Function**

To support the relief activities of volunteers and group moderators in particular, a function for searching and filtering information is needed, as we have seen. Groups and pages are often regionally based and therefore require filtering by location, while time-based filtering enables a further selection of the information supply. As moderators in particular search their groups for information in order to coordinate offers of and demands for help, it is essential to include data from groups and pages of the specific user in the search. The search function obtains the data from a social media API developed for this purpose. The API provides relevant messages from Facebook and Twitter in the Open-Social format (<http://opensocial.org/>) and offers parameters for the time- and location-based filtering of posts. Using tokens, we can also access data from the user’s restricted FB groups, if s/he has agreed and installed the XHELP FB app. In order to further support the aspects required for fil-

tering and assessing information by users, the social media API is combined with an *quality assessment service* [32]. This tool enables the weighting of 12 different assessment criteria (time, space, reputation, metadata, sentiment analysis, fear factor, happiness factor among others) for search requests in addition to the filter options mentioned above. This means that the order of the search results can be controlled (Figure 2).

In the *general* section, users can type in search strings, choose the media to be searched and specify both a search period and a location, including a search radius (A). It is also possible to relevant FB groups or pages. The subsequent collapsible field-sets offer optional assessment criteria to impact the order of search results. Alternatively, the search results can be sorted by time, local proximity, and platform (B). If a user defines more than one criterion, the degrees of fulfillment will be shown in percentage and color during a mouse-over (C). Next to the list of the search results is a map (Figure 3) visualizing the set location as a green marker, the search radius as a blue circle, and the search results with geo-coordinates as red markers (D).

**Publication and Management of Relevant Messages**

The empirical study revealed that groups are closely linked to regional areas, but information requirements cannot always be met within the confines of the area in question. The posting function (Figure 4) of the application aims to support information retrieval by moderators and volunteers by providing the opportunity of publishing messages on multiple channels simultaneously. Here Twitter is provided as a publication channel in our evaluation without the need of a Twitter account. In a real-world setting, this would not be feasible or would at least be legally difficult. Clicking the label “Create new posting” (Figure 5) on the left navigation bar shows the view of a message publication. The user types the message into a text box before selecting the channels for publication (E).

Closely tied to the posting function is a dashboard view that summarizes created posts along with relevant metadata. Since postings are published cross-platform, the user has to

be supported in the management of these postings and related comments by providing an overview. The dashboard is intended to give the user an overview of his/her activities and to enable direct interaction with the responding authors without visiting each channel individually.

The dashboard contains the overview “My Postings” (Figure 5). Alongside the postings published within XHELP, it contains the user's postings or commented postings that were created beyond the application on the source platform to give an entire overview of the user’s activities. Once a post is commented on, it will be attached chronologically with a reference to its source platform (F). For the sake of clarity, the dashboard displays a maximum of five comments per posting; and with an arrow symbol in the top right hand corner of a posting, the user can collapse or expand the comments on a posting. The user can respond to each comment and delete their own. The top right hand corner of a posting contains symbols for deleting and finalizing the correspondent posting (G). With the “finalize posting” function, the user has a dialog-based opportunity to write a concluding posting informing all related groups, pages and media. The empirical study showed that users published their requests in multiple groups but neglected to inform each group individually whether requests had been settled. In order not to waste resources on matters already dealt with and to prevent *dead postings*, XHELP supports the user in finalizing and/or deleting successful requests or postings and informing the participants of interaction. The posting will not be displayed in “My Postings” anymore, but is still accessible in the left navigation bar.

In summary, XHELP blends together multiple aspects of existing (commercial) approaches within the scope of volunteer activities: It provides dashboard features [3, 42, 43], bidirectional and cross-media communication [35], and with “finalize posting” a basic task management function [15]. Moreover, the information search is enriched by map-based visualization [12, 24]. Additionally XHELP has no syntactical requirements and is embedded into an established context of use.

**EVALUATION WITH VOLUNTEERS AND CITIZENS**

To assess the concept and the potential value of the web-application XHELP, an evaluation of the search for, filtering and assessment of information functions and of cross-channel functionality (Facebook, Twitter) was conducted. The philosophy behind the evaluation process was derived from the notion of “situated evaluation” [41] in which qualitative methods are used in order to draw conclusions about real-world use of a technology using domain experts. The aim here is not to measure the relationship between evaluation goals and outcomes but to derive subjective views from experts about how useful and relevant the technology might be in use. XHELP was therefore evaluated with 20 users (E01-E20) whereof six participated on a first version of the prototype and were not involved in the follow-up. Of the remaining 14, four participants had been initiators and moderators of Facebook pages during European floods (three of them had already been interviewed during the empirical case study). Their experience as active volunteers generated some valuable feedback.

The evaluation was based on a scenario-based walkthrough coupled with subsequent semi-structured interviews. The scenario was designed to introduce the participants to the character of a disaster and the role of the volunteer (only if he/she was not already an experienced volunteer). It was based on hurricane Xavier which caused heavy damage on the coast of Germany in December 2013. The participants were given a general description of their role with regard to dealing with the information demands of affected citizens with the help of XHELP. The participants were then given the opportunity to explore the application, on the basis that they would be given a concrete task to tackle afterwards. The first step of the task required them to search for and filter specific information pertaining to water levels. For this purpose, the search function was extended with an evaluation mode. Search results were premised on preselected data records to ensure the comparability of the participants’ results. The second step instructed them to ask for additional information about the condition of the dikes using the publication function, whereupon our team created some responses from both



Figure 4: Create new posting

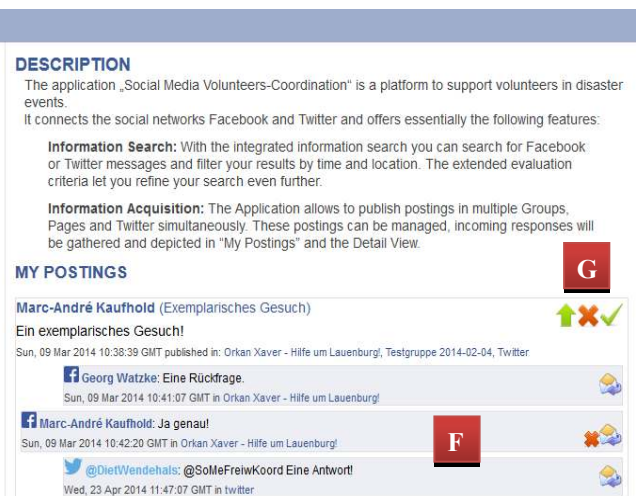


Figure 5: Dashboard with “My Postings”

platforms to enable the use of the response and finalize functions. Following the think-aloud protocol [16], participants were asked to express their thoughts while completing the task.

The semi-structured interviews which followed were intended to encourage reflection on the evaluation process, on ease of use and on the overall value of the application. The questions were specifically oriented towards overall impressions, the advantages and disadvantages of XHELP, coverage of information demands, possible overload and problems of cross-platform information acquisition. The interviews were analyzed and categorized systematically. We employed “open” coding i.e. gathering data into approximate categories to reflect the issues raised by respondents based on repeated readings of the data and its organization into “similar” statements. We clustered positive and negative aspects of the (a) search and (b) dashboard functionality, as well as the (c) usability and (d) potentials of functional enhancement. Taking into account the quantity and originality of aspects as well as the participants’ domain expertise, we created a rating for each cluster. The most noteworthy contributions will be presented subsequently and thereafter shaped into design requirements.

### Results I: Cross-Platform Search and Assessment

Ten interviewees regarded the search refinement and sorting of results as being valuable, especially when dealing with large amounts of data. In contrast, some negative views were expressed. Eight interviewees deemed the selection of criteria to be too extensive, resulting in complex searches which might hamper quick results. Additionally, E20 suggested that some means of assessing the emotional content of messages was needed, since it bore some consequences for perceived accuracy:

*“If someone is upset about something that isn’t correct at all and then spreads wrong information and next other people follow it, it has to be counteracted rapidly” (E20).*

Two participants argued that an automatic information assessment might result in over-reliance on the application and could potentially result in the loss of relevant search results. E20 doubted that an information search with search terms was useful for identifying offers of, and demands for donated items:

*“But then, if I search for donations, they don’t show up, but rather I have to enter ‘dusk mask’. But I cannot always search through all search terms. If it is somehow possible to reasonably filter offers of donation computer-linguistically, that would be certainly handy” (E20).*

More positively, nine interviewees deemed search functions based on chronological and regional proximity to be important. The visualization of a search radius, the ability to identify their own location and see search results on a map were all seen as enriching information value. Broadly, this is because these functions enabled better judgment about information relevance in relation to rationality, priority and

reliability (E17). A search for general, repeated and crisis-specific verbs or syntaxes, that *“are easily and always tracked in the background for a certain disaster”* (E20), would therefore be a useful addition.

### Results II: Cross-Platform Dissemination of Posts

Altogether, we saw benefits in terms of the reduction of the overhead. Publishing posts in multiple groups, pages and platforms simultaneously was seen to be much easier. Through the centralized presentation, an overview could also be obtained:

*“I really like it. It saves a lot of work, because before, you had to visit every single page and that wasted too much time: You do not have enough people that can help” (E19).*

Seven interviewees thought that the application speeded up their information searches over different information sources and the broader bandwidth of platforms. During the selection of dissemination channels, six participants selected Twitter to increase the audience of readers. Three people indicated explicitly that they value the opportunity to publish postings in Twitter without owning an account:

*“You essentially built a bridge [...]. This is awesome, because many distribute their information through Twitter and have the opportunity to use Twitter without even owning an account or looking for followers or whatever” (E18).*

Further, four participants expressed a positive attitude towards finalizing a posting, or at least the opportunity to publish summary messages, on all channels simultaneously. This circumstance and the resulting reduction of effort are emphasized by E18:

*“What I really liked was the function to finish a posting, or to extend or change the demands; you did not need to search in twenty groups ‘Where is the post?’ to edit or comment it, but rather it was done immediately” (E18).*

### Results III: Reliability of Gathered Information

During the evaluation, eight participants expressed concerns about the reliability of information, which they gathered with the search or dissemination functionality, and identified different ways in which they went about validating information. Two navigated the public profile of the message author to gain an impression of this person:

*“Then I would try to evaluate the information based on the history of the person, which means if a person published quite a few postings in the past that were meaningful and correct, then I would be more likely to believe in the correctness of information” (E12).*

Three interviewees wanted to check the reliability by confirmation from other users and two sought direct contact with the author. The consultation of other sources is linked to some other concerns as stated by E16:

*“Someone might ascribe too much weight to information on these networks which has not been validated officially. Be-*

*cause I remember that there were several false reports [...]. That could raise panic or something” (E16).*

E16 suggests (similarly to E8) that false reports are a serious problem. Beyond that, she considers local information to be more reliable than remote information.

#### Results IV: Potential of Functional Enhancement

A number of comments were made about improving XHELP’s functionality. Five participants requested the possibility of self-selecting groups, pages and networks, ensuring that only relevant crisis information is managed within the application:

*“An incredible amount of people [...] have hundreds of groups. To select the relevant groups again and again from post to post [...] is too time-consuming. Maybe you can select [...] groups to be associated with the app” (E18).*

Further, three interviewees see potential in the integration of additional social networks, e.g. Google+. Another person mentions the integration of news webpages within the search functionality (E15). To increase XHELP’s breadth of usage, E18 wishes *“that if the application is released, it will be released on smartphones [...], because many people are on the road and do the whole [response work] not at PC or laptop, but on a smartphone” (E18).*

Furthermore, E18 suggests improved contact support among the users of the application to connect people with similar objectives. Thus new relations between volunteers or communities can emerge:

*“Maybe it would be interesting to see other users of the app [or] who are searching for the same thing and using the app and who have the same interests as me” (E11).*

If task completion is to be achieved cooperatively, E20 asked for a joint view within the application:

*“It would be very important for the organizers of the same group [...] to have the same overview, because otherwise you do things twice or three times [...], so you simply need the same information” (E20).*

Overall five participants asked for the ability to evaluate obtained information. Three of them explicitly mentioned the ability to sort comments or select a “best answer”:

*“It would be nice [...] if you had the option to actually mark the question answered or to highlight the respondent who answered the question. So that anybody searching for the answer does not have to go through all the comments initially” (E12).*

Concerning the search function, two interviewees requested the ability to manually evaluate search results along with the automatic assessment and to be able to put selected results into a favorite view (E08). Similarly E20 proposes a function to exclude unreliable sources and to purposefully search for messages of certain, reliable or official authors. Authorities themselves are seen to be reliable information sources. Thus E15 wishes *“that the corresponding official establishments*

*such as police, fire service etc. write appropriate messages, in the knowledge that people can access them in any case through this application” (E15).* E19 complains that otherwise official information is disclosed *“much too late and not comprehensively” (E19)* to self-organized helpers.

#### DISCUSSION OF DESIGN REQUIREMENTS

The evaluation reveals four design requirements as being essential to enhance the value of an application that provides a cross-social-media support for volunteers during emergencies:

First, *overview and avoiding barriers of usage*: The basic principle of a Facebook application that enables interaction patterns, the display and content of social media already in use is demonstrably beneficial, according to our respondents. The evaluation, however, showed that there is need for an information management tool which allows some kind of overview and transcends existing barriers. Extended configurations imply further possibilities for improving the information overview, especially in terms of providing a common overview that moderators and teams can rely on.

Second, *user-defined information management*: A custom information management is required because of the varying preconditions, assessments and working procedures of the participants. Options were requested for selecting relevant application channels to include or exclude information from groups or sites that they saw as relevant or irrelevant to their demands. Furthermore, the scenario showed that users wanted a component to manage favorites, e.g. storing valuable search results or relevant answers obtained using the cross-platform posting function.

Third, *support for self-assessment and information verification*: The participants wanted support for information assessment according to specific qualitative criteria to enable them to search purposefully through the vast flood of data in social media. At the same time, they expressed a desire to self-evaluate posts or comments and to highlight relevant comments. Such a function could be used to improve the filtering and classification of upcoming search queries [5]. As the data is investigated, the process can be assisted by giving easy access to a message creator’s public profile, supporting the establishment of contacts and enriched information about the poster. Since official crisis response information is considered to be more trustworthy, the integration of that data into the process of information assessment or into the application is preferable.

Fourth, *amplify potential for cross-platform networking*: Interviewees see advantages in cross-platform information processing because faster responses are possible and the general view of the integrated platforms reduces management effort. The functionality of finalizing postings is perceived as assistance to formulating cross-platform status updates and to finishing help activities.



**CONCLUSION**

Our paper examines the work of volunteer communities in disasters focusing on the empirical analysis of social media activities as well as interviews with moderators of volunteer groups in Facebook and the evaluation of the novel web-application XHELP. This is intended to support volunteers during crisis events.

The case study of the European floods in 2013 [18] emphasizes the relevance of social media in Germany for the first time. Twitter has been used broadly as a platform for status updates, while Facebook pages gave a situational overview and Facebook groups coordinated a multitude of virtual and real help activities. This confirms the findings of Hughes et al. [16]. Among affected citizens and volunteers, some particularly motivated people adapted the role of “moderators” to mediate offers of and demands for help with the use of the technical functions of the social networks. This extends the role model of Reuter et al. [30]. Our examination shows the main challenges, which are (1) clarity and representation of relevant content; (2) moderation and autonomous work; (3) feedback and updates in interaction relationships and (4) integration of technologies and interaction types for the design of social media for volunteers in crisis.

Evaluating our web-application XHELP, we showed that a cross-platform search, especially with time and location filtering options, contributes to the channeling of the information flow. Furthermore, cross-platform posting provides an overview and reduces overhead with its centralized management. The embedding of Twitter is seen as an opportunity to increase the range of search and distribution activities. The interviewees mentioned the reduction of search criteria and possibility of self-assessment and filtering of information to gain an overview of the relevant activities as potential sources for improvement. The main results of the evaluation can be summarized as (1) avoiding barriers of usage with supportive tools; (2) user-defined application configuration and information management; (3) support for self-assessment and information verification and (4) amplifying the potentials of cross-platform networking.

Compared to related work, our approach provides several contributions: Addressing the “chaotic” use of social media [4, 44], we implemented functionalities to render social media “more listenable” as suggested by Hughes et al. [16] (which is also interesting for crowd monitoring [19]), e.g. by showing related discussions in various social media and by using a cross-social-media function to finalize postings. In order to support current working practices, Cobb et al. [5] suggests querying multiple social networks with filters. We have implemented such a function. Our app enables its users to disseminate messages (including backchannel [8]) to various social networks. We propose that our approach enhances the state of the art in presenting empirical data, a concept and its implementation, which e.g. amplify the potential of cross-platform networking. Other tools, such as Ushahidi, automate the collection of incident reports and facilitate the mapping of report locations [21] but are developed as external platforms

which have to be deployed manually. Our app is integrated into Facebook and supports established interaction types [30] while still having a cross-platform focus without the burden of syntactical requirements [37]. The integration of additional social media platforms promises to further enhance the cross-platform concept in future. XHELP will then be able to support volunteer’s emergent collaboration [33] not only across time and space, but also across platform, group and page.

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