

Information and interaction needs of vulnerable groups with regard to disaster alert apps

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Summary

In recent years, disaster management agencies introduced alert apps in order to inform the population in case of disasters. Initially, app design was focused on the average citizen and his or her information and interaction needs. However, vulnerable population groups need additional information or may have specific interaction requirements due to various types of impairments. This paper discusses how the needs of different vulnerable groups can be addressed. It also analyzes the suitability of an off-the-shelf disaster alert app for deaf people by presenting results of an exploratory field test.

1 Introduction

Disaster alert apps have become a widely used tool to inform the population about upcoming and ongoing disasters, to inform them about possible consequences, and to instruct them how to behave and which protective measures to take so that the consequences of a disaster can be minimized. One example for such alert apps is the KATWARN system in Germany (Skrbec 2011). This system is currently used by disaster management agencies in more than 60 counties to inform the population about all types of disasters, and it is available for Android, iOS, and Windows Phone platforms. Other examples for disaster alert apps are NINA (a general-purpose disaster alert app also from Germany, BBK2016), Alerta Sismica (a Mexican disaster alert app with a particular focus on earthquake alerts, Alerta Sismica 2016), and SAIP, an app provided by the French Interior Ministry to provide the population with alerts on major crises (with a special focus on terrorism alerts, Ministère de l'intérieur 2016).

One key issue of concern for authorities is that they want to communicate consistently with the population via all available channels. This is why most of them have adopted a “one message fits all” approach so far, sending out one standard message to everybody (Dressel and

Pfeil 2014). Initially, authorities have been sceptical about addressing various target groups, because they were afraid that doing so may lead to confusion, and mistrust (Dressel and Pfeil 2014). However, there is no question among authorities that different vulnerable groups do need special attention and information. Reuter (2014), for example, emphasizes that disaster information should be setting specific, which means that it should take personal characteristics of the recipient such as age or different types of diseases into account. Discussions which the authors conducted with emergency managers showed that they have no objections about sending additional message components to vulnerable people

- if everybody, whether vulnerable or not, does receive the standard message
- if the instructions for vulnerable people do extend the baseline message, and
- if everybody can easily understand why the recipient has received the additional information.

As a consequence, personalization of alert messages is now becoming accepted as one way to enhance the impact of disaster alerts and warnings, in particular among vulnerable groups. This paper is going to analyze the specific information and interaction needs of vulnerable groups that have been identified in the literature and in expert interviews (section 2). Where available, possible solutions will also be mentioned in that chapter. Section 3 then presents the results of an exploratory field test of an off the shelf disaster alert app with four deaf people. Finally, Section 4 will provide some conclusions, and identify issues of future research.

2 Information and interaction needs of vulnerable groups and how to address them

A literature analysis, accompanied by 26 interviews with practitioners (Dressel and Schindler 2011)¹, identified the following vulnerable groups with additional information and interaction requirements with regard to the use of smartphone-based disaster alert apps:

- Migrants and tourists are vulnerable because they are often not familiar with the location and its dangers, and because they often do not speak the main language (Dressel and Pfeil 2014). Therefore, it is advisable to provide alert messages in different languages, and to offer links to additional background information for those who need it. Visual clues on the disaster may also be provided by using pictograms (Kusano et al. 2014) or images from webcams nearby (see, for example, the MORECAST app from company UBIMET). Another way to address tourists and migrants more efficiently may be easy-to-understand plain language (for those cases where no suitable translations are available).
- Illiterate people will not be able to understand any text messages. In this case, the information could either be provided with the help of a text-to speech generator, or –

¹ The interviews were conducted by one of the authors and his project partners as part of the Opti-Alert project.

as in the case of tourists and migrants - by including visual clues about the disaster situation.

- People with cognitive disabilities or dyslexia can also be more efficiently addressed using pictograms or plain language.
- Mobility impaired people are often unable to evacuate themselves and may need a dedicated emergency number to call for assistance during evacuations.
- Parents with small children need information about the whereabouts and well-being of their children, if the latter are out of home (e.g., at school) when disaster strikes (Dressel and Pfeil 2014)
- Unaccompanied children aged 10 to 16 are also considered to be vulnerable due to their lack of experience on how to behave in case of disasters. Here, apps can be used to inform (about necessary protective actions), and to reassure the people concerned to reduce stress and anxiety.
- Blind people obviously need a tool for text-to-speech transformation in order to be able to understand the alert (National Research Council 2011). They are also unable to interpret images, so that all visual clues should be accompanied by a textual description for the visually impaired. Screen readers which are an integral part of many smartphone operating systems are a useful help here. Blind people also may have difficulties with orientation, e.g. during an evacuation in an area they are not familiar with. In this case, standard recommendation is that blind people should join other people during the evacuation so that they can be guided to safety. However, this may not always be possible (no other people around, or when the other people in the area have been injured). In this case, information systems can give some guidance to blind and visually impaired people on the direction where to go. However, such guidance systems (for a discussion, see Klafft et al. 2011) are unable to highlight obstacles that have appeared recently (e.g., debris), which is why mobile guidance systems can only be an additional tool in an evacuation of the blind people – in addition to service dogs or white canes.
- Colour-blind or red-green blind people will have difficulties in distinguishing the different colours used to indicate the severity of an alert (in particular, as many of these schemes use red to indicate high dangers and green either for “pre-alert” or for the “all clear”).
- Deaf people are not susceptible to warning sounds, and they usually also have difficulties in communicating with bystanders. Additionally, deaf people are often very focused on one aspect of their surroundings (“eye-busy” situation), so that it is particularly difficult to gain their attention (National Research Council 2011). Proposed solutions include the use of flashlights (where available), vibration alerts on smartphones, or converting the smartphone screen into a kind of flashlight by constantly alternating between bright white and black. For most deaf people, sign language is their native language, which is why providing videos in sign language to explain the emergency could be advantageous (National Research Council 2011, Mitchell et al. 2010). For frequently occurring disasters, it could be possible to download and store sign language videos on the device (a similar solution was prototypically tested by Mitchell et al. 2010). This information would not be optimized for the ongoing crisis, but producing new videos in sign language and

transmitting them to the recipients' mobile devices during an acute crisis will often be problematic due to bandwidth issues and organizational limitations.

Existing disaster alert apps support some of the required features so far (e.g., text to speech conversion of the standard message text). Furthermore, approaches have been proposed how to personalize alert messages for vulnerable groups, either through extensions of the Common Alerting Protocol (Tsigka 2013), by parsing incoming alert messages in accordance with defined user profiles (Onorati 2013), or by adapting proposed evacuation routes to the recipients' limitations (Onorati 2013).

However, it is not clear to what extent operational alert apps already meet the requirements of vulnerable population group. Furthermore, the authors were approached by the Bavarian Deaf People's Association ("Landesverband Bayern der Gehörlosen"), which highlighted the importance of suitable disaster alert apps for its members. Therefore, we decided to conduct an exploratory field test of the existing alert app KATWARN with this specific vulnerable group, i.e. with deaf people. The goal of this test was to analyze to what extent an existing, off-the shelf disaster alert app already meets the deaf users' requirements, and where additional development steps will be needed.

3 Field test

With the assistance of the „Landesverband Bayern der Gehörlosen e.V.“, four test users were acquired for a field test of the KATWAN system in Southern Germany. After registering for the study, test users were instructed about the purpose of the study, that is, to get to know how test users perceive the alerts which they will receive at random during the test period. Users were instructed to keep a diary about anything special that they experience during the tests. Test alerts were sent without prior notice between June 22nd, 2015, and July 5th, 2015. Alert texts were based upon standard alert message templates used by regional disaster management agencies, which means, that the simulated alerts referred to disaster types that could occur in the given region. The personnel triggering the test alert also paid attention that the alert texts were adapted to the current situation (e.g., because the test was conducted in summer, alerts for extreme frost or black ice were excluded from the set of possible alert messages). However, in the beginning of each alert message, the words "Test alert" were added to the standard texts in order to make sure that all participants understood that no real disaster was taking place.

On July 5th, after the field test had been completed, test users received an e-mail with a link which invited them to present their feedback using an online questionnaire. The questionnaire asked about their perceptions of alert content, notifications, etc. Feedback was collected using a five point scale ranging from "fully agree" to "fully disagree". Additionally, fields for free text comments were provided to the participants in order to collect more detailed feedback. The questionnaire-based approach was selected because interview techniques (usually applied in such small-scale studies) were difficult to conduct lacking a sign-language translator.

Due to the limited number of participants, results have to be considered as purely explorative and need confirmation in a larger study. In general, the existing system did meet the requirements of the participants:

- All users agreed that they would trust the system in an emergency and would even recommend it to other people they know.
- All users considered text messages to be understandable and the content of the baseline message was considered as sufficient for deaf people.
- None of the users considered the vibration alert as insufficient (with two neutral evaluations).
- However, one user voiced concerns that a vibration alert could be confused with other, less urgent messages (such as receiving ordinary text messages). It is therefore advisable to make the vibration alert more unique (e.g., by employing a dedicated vibration pattern, as previously suggested in Mitchell et al. 2010), and to combine it with some visual alerting feature, e.g. making the smartphone display flash (which can, in fact, be noticed even through thin trousers, as the author's own experiences show).
- Responses with regard to ease of use of the system were in part contradictory. Initially, all respondents fully agreed that deaf people would be able to learn easily how to use the system. However, when going more into depth and asking about the participants' personal experience, half of respondents mentioned that they may need help of a technically versed person to use the app properly, which is in contrast the answers to the first question. We therefore recommend that an explanatory video in sign language should be provided in the app itself and on the internet to overcome any remaining problems with ease of use.

One user observed that the loading time of maps and other content can be quite long. He recommended to provide purely text based alerts as an alternative option.

4 Conclusions and Outlook

Goal of our research was to summarize the information and interaction requirements of vulnerable people in case of disasters. For the case of deaf people, we wanted to assess to what extent design recommendations from the literature have been taken into account in the design process of an existing alerting system, and how this system is perceived by the target group.

Therefore, we conducted an exploratory field test to find out how suitable a European off-the-shelf disaster alert system is for the specific needs of deaf people. The study indicates that deaf people do not have any problems with understanding the standardized text messages currently in use by the system. Furthermore, test users did not have any additional information requirements compared to citizens without disabilities. However, the study also showed that some additional modifications are needed to assure that deaf people do not confuse alerts with ordinary messages. Therefore, the authors recommend that the following issues will be considered in all future alert app development activities: adding a dedicated vibration pattern

for alerts is proposed in line with literature recommendations, and it is suggested to let the smartphone display blink black and white as soon as an alert is received. It is also recommended to provide an explanation of the alert app as a sign language video in order to facilitate installation and handling.

In the future, our research should be complemented by a larger study to confirm these initial test results, and to provide a more in-depth analysis of how satisfied other vulnerable population groups (e.g., blind people) are with existing alert systems.

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