Communicating storm surge risks via risk communication websites: a novel approach

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ABSTRACT

Websites related to storm surge risks mostly follow an instructive approach, often combining flood risk maps with historical information on floods, and instructions on how to behave in case of an approaching emergency, such as a dike break. Sometimes, these websites are enriched with additional media materials (photos in particular). However, while accurately representing flood risks in a matter-of-fact style, these websites neither highlight what such disasters actually mean for the everyday lives of the people concerned, nor do they appeal to the visitor's emotions - which is known to support the learning and personalization process related to the risk communicator's message. Therefore, the authors provide a concept for a risk communication website that combines oral history gathered via local citizen science projects with a reflection of flood disasters in the arts.

CCS CONCEPTS

Applied Computing: Education – Computer-managed Instruction.

Human-centered Computing: Interaction Design – Interaction Design Theory, Concepts, and Paradigms.

KEYWORDS

Risk communication website, Storm surge risks, Citizen Science Projects, Oral History

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1 Introduction

Risk communication has traditionally been regarded as a process where "experts inform … others about the truth", that is, "the transfer of scientific facts and a set of conclusions drawn from those facts" [1, p.227]. In practice, this narrow definition of risk communication relates to plans executed by authorities or regulatory bodies "targeted to a special audience and embodying specific outcome goals for behavior or attitudinal change" [1, p.227]. In the case of storm surges, the goals of risk communication by authorities are (a) an increased risk awareness of the population, and (b) increasing the resilience of the population through better knowledge on such disasters, and better preparedness. However, risk communication activities have to overcome some challenges in practice. It turned out that it is not sufficient to just "reach" the audience, because there is, for example, a tendency among people to deny that they are actually endangered or at risk [2], or because citizens do not trust the risk communicator. Therefore, Plough and Krimsky [1] already pointed out that a broader approach to risk communication is needed, which should also include "non-elites" as risk communicators.

In addition to reaching the audience and providing information that is regarded as trustworthy, risk communication on storm surges is also related to science communication, and learning: citizens should learn about the causes and effects of storm surges, should be aware of danger zones, and should remember how to prepare themselves, and how to act in case of a disaster. Therefore, risk communication also has to take into account findings from educational theory, and practice. One important finding is that "the knowledge gained needs emotional support to be made useful and applicable in the real world" [3, p. 66, based upon previous work by 4]. However, emotions only have a positive effect on learning if they are not too strong [5]. [5] also argues for the inclusion of the arts in learning processes, since these are particularly useful to support inter-generational learning.

In this paper, we analyze the status quo and identify possible improvements with regard to risk communication websites on storm surges in Northern Germany. We selected this case because the situation in Northern Germany is particularly challenging,

since disaster preparedness is not a mandatory part of school curricula there despite an existing substantial risk. Therefore, authorities need to undertake additional efforts to communicate with the citizens about the need to prepare. The situation is furthermore complicated by the fact that storm surges with a disastrous impact do happen in the region, but are rather rare (every 50 – 100 years). However, their likelihood will probably increase in the future due to climate change. Other more practical reasons for selecting this case were (a) that the authors' university of applied sciences is located directly at the German North Sea Coast, (b) that storm surges and related flooding are a research topic at said university, and (c) that the researchers there are well-connected with the regional education community.

2 Related work

Most existing risk communication websites on storm surges for the German North Sea focus purely on informing the visitors about possible hazards. They mainly outline relevant danger zones and provide recommendations for increasing the people's resilience [6]. They neither appeal to emotions, nor do they include laypersons or the arts for risk communication purposes. [7], however, proposed a concept to use digital storytelling as a means to inform people about the 1962 storm surge disaster in Northern Germany. [8] provides a collection of written eyewitness reports of the 1962 storm surge, enhanced with some historical photos, but transcripts of survivor interviews show that the input does not appear to have been collected using interview guidelines with a particular focus to increase the readers' disaster preparedness.

When considering risk communication strategies, communication via websites needs to be embedded into an overall risk and crisis communication concept. Studies related to crisis communication research implicate the need to communicate over a plethora of communication channels in order to better reach the target audience [9], and point to an increasing relevance of social media and disaster alert apps [10]. Using a multi-channel communication approach is also useful in risk communication, although the focus here is less on redundancies against communication breakdowns, but rather on reaching the audience in the type of media to which they are used to, and which they use on a daily basis. Alert apps can also be a part of a risk communication strategy, since they are used by about 16% of the people in Germany [11], and because they offer the opportunity to send test alerts that provide the users with precise instructions on how to behave in case of a disaster. However, appealing to emotions and to the arts in a disaster alert app would be counterproductive, because this could raise concerns among the users about the app's focus, and its nature as an "official" communication channel.

An additional dimension that needs to be taken into consideration when designing risk communication approaches is risk culture. According to [12] and [13], the so-called state-oriented risk culture is predominant in Germany. This means that citizens believe that disaster prevention and preparedness can avoid harm, but they place the responsibility for taking necessary action with the state. Therefore, they are less willing to prepare themselves because they believe that the state will take care of everything. This is also an argument why it is not sufficient to rely on official, factual communication by the authorities (e.g., via disaster apps), but necessary to involve non-expert risk communicators like disaster survivors, and to appeal to emotions, in order to overcome cultural impediments for individual disaster preparedness.

3 Research question

Within this paper, the authors want to answer the question "how the impact of risk communication via websites on storm surges in Northern Germany can be improved through a holistic approach that goes beyond the communication of factual advice on disaster preparedness". In a second step planned for future research, the authors would like to analyze how web-based disaster communication platforms can provide open educational resources for such a holistic risk communication approach to multipliers in Germany (but also in other world regions with similar natural disaster risks).

4 Conceptual design considerations

As the discussion of related work revealed, there appears to be a potential to improve the impact of risk communication websites by including additional information that goes beyond official factual recommendations or advice. Based upon the analysis of related work, the following general requirements can be derived for the new concept:

- appeal to (moderate) emotions,
- include works from the arts and literature, and playfulness to improve learning, and
- include risk communicators which do not have an official function or capacity,

in order to overcome the challenges that state-oriented German risk culture poses for risk awareness and disaster preparedness.

In a second step, a brainstorming was conducted how these requirements could be met, and how existing risk communication websites for storm surges at the German North Sea coast might be improved. The results were as follows:

- In order to facilitate the personalization of storm surge risks, eyewitness reports – in particular including eyewitnesses from the specific area – should be presented at the website (oral history).
- If available, photographic and / or video footage from the region should be presented as well, ideally with the goal to highlight the impact of a storm surge disaster (e.g. with before-after-comparisons).
- Inclusion of the arts can be manifold, and may comprise excerpts from literature, or the presentation of paintings dealing with storm surges (copyright issues need to be respected). To increase the participation of the local population, the artworks presented may even be

obtained / generated through regional art competitions that address the topic of storm surges.

- Additionally, the factual recommendations that are already present at existing risk communication websites have to be included as well.
- In order to convey this factual information in an interesting way to a broad age distribution of the target group, it is advisable to convey the contents interactively.
- Therefore, the website should be implemented as a lean-forward-medium in order to enhance user involvement and thus improve the reception of contents.
- In times in which our mobile phones are now small computers, more and more websites are accessed with the mobile phone. It is therefore important to design the website responsively so that it can also be used from mobile devices.

If not yet available in the public domain, multimedia materials (survivor interviews, photo and video footage of historic disasters, eventually paintings) may be collected or produced as part of citizen science projects involving local schools, volunteer organizations, or regional universities (for more details on the organizational concept, see [14]). Doing so will offer the opportunity to start an intergenerational discourse about storm surges, and the citizens involved (pupils, students, volunteers) will act as additional multipliers within the society.

The proposed approach appeals to the viewer's emotions as follows (in line with the emotional dimensions outlined by [15]):

- The presence of local survivors raises social emotions in the form of sympathy.
- The presentation of multimedia materials, and regional artworks can raise emotions of interest, and admiration.
- The presentation of artworks can create – in addition - emotions of surprise, excitement, and maybe amusement. These emotions may be particularly strong in case of regional art competitions, or artwork provided by locally well-known citizens.

Negative emotions such as fear can and will also be raised, but it is important to make sure that these emotions do not become too overwhelming, because strong negative emotions are known to have a negative impact on learning. It would therefore be not advisable (and also unethical) to show photos of victims who deceased due to a storm surge, for example.

5 Implementation

Strangmann [16] developed an initial implementation of the proposed concept as part of a coursework in a risk and crisis communication class at Jade University of Applied Sciences in Wilhelmshaven, Germany. To facilitate the implementation, the pageflow framework for website development was used [17]. This tool makes it possible to prepare the collected contents in multimedia and interactive form.

First of all the website introduces the user to the topic with the help of a short introductory video. Then it's the user's turn. The user can decide for himself which information area of the website he wants to access first. In this way, the user is not only asked to watch and listen as in the case of a pure film, he can select, scroll, click and explore the topic in an interactive way.

The website is divided into three sections: The user can listen to a poem / story about storm surges, learn about the dangers of a storm surge, and get tips that can help with approaching storm surges.

Figure 1: The landing page

In this case, the "arts" section presents the character of "Der Blanke Hans" – a mythical impersonification of the violent North Sea from literature and history. A famous and well-known poem on this impersonification of the violent sea [11] is presented both as text and as an embedded video [12]. Because the author lived and wrote the poem in the 19th century, and because the video is embedded, no copyrights issues had to be observed.[1]

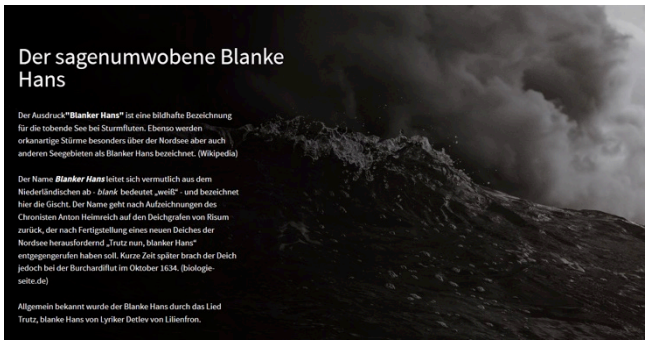

Figure 2: Impersonating the violent North Sea with a fictitious character from literature

The second section deals with the impact of storm surges. Here, a mix of embedded video reports from mass media, survivor interviews, and photographs including a before-after-comparison are presented. At this point, images and texts are enriched by

[1] According to German law, copyright expires 70 years after the death of the author.

discreet background noises such as wind and water, so that the website visitor feels more put into the situation. Appropriate background noises can also appeal to the visitor's emotions, thus supporting learning.

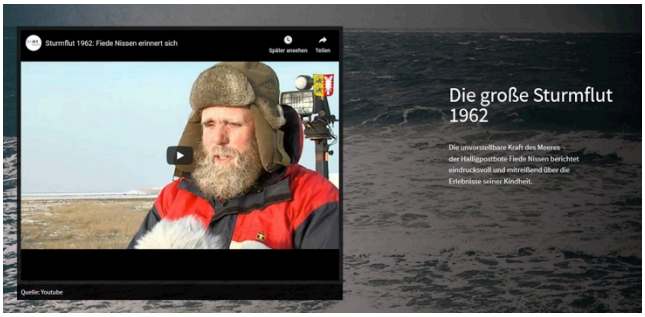

Figure 3: Embedded eyewitness reports on historic disasters

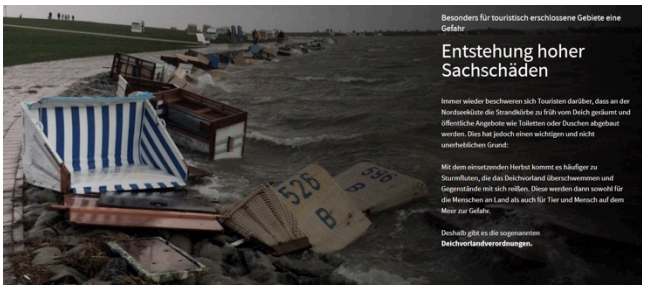

Figure 4: Visualization of possible damage

Please note that the most severe consequences (several people died) are deliberately only mentioned orally or in the text (and not presented visually). The third section deals with instructions how to prepare for storm surges. Although this section is mainly informational and instructional, the section is enriched with a historic radio broadcast on the most disastrous storm surge in the last century in Germany, and it uses high-quality photos to underline the instructions given.

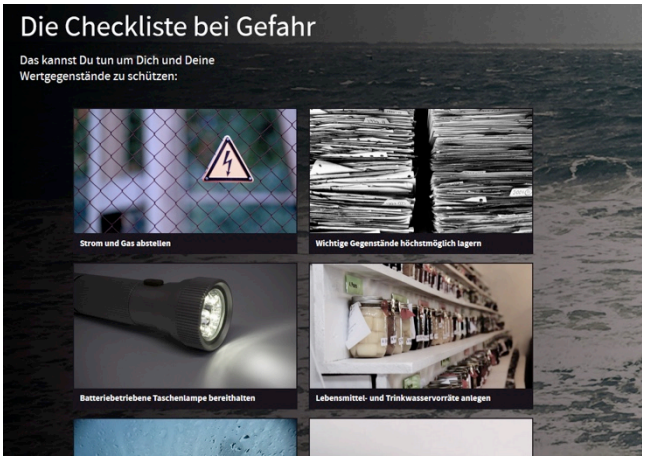

Figure 5: A checklist with key instructions for disaster preparedness

Figure 5 presents a checklist with recommendations to prepare for storm surges – more detailed instructions and explanations can be obtained by clicking on the different topics. Finally, useful links to additional information, such as water level forecasts, official brochures for disaster preparedness, or storm surge alert sites are shown to the users.

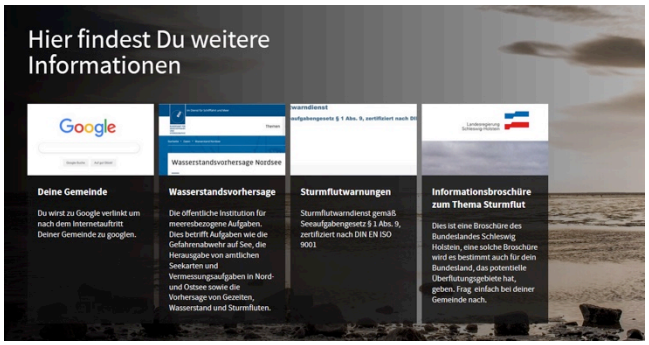

Figure 6: Links to additional external resources

The risk communication website has been presented at the "Flood Protection Day" in Wesermarsch county in Germany in May 2019, and it is available as an open educational resource to the public. A teacher from a regional high school, and a disaster manager have evaluated it so far. This initial evaluation was positive, and the material will likely be used as part of an extracurricular learning activity on coastal areas in said high school. It is also planned to use the website as a reference in risk and crisis communication classes on natural disasters. However, end-user assessment is still at an early stage and needs to be extended during the following months. In accordance with the classification of HCI research contributions proposed by [20], we plan to provide a combination of empirical research contributions (e.g., cognitive walkthroughs or interview studies) with artifact contributions during this process.

6 Ongoing Activities

In addition to a more in-depth end-user assessment, we are currently conducting semi-structured interviews with survivors of historic storm surge disasters in the region as part of the CITADINE research project, which is funded by the German Federal Ministry of Education and Research in the framework of the ERANet-Lac program. One goal of this activity is to replace the embedded YouTube videos with our own video and audio material for different reasons:

- Creating our own survivor interviews ensures that the interview content will match our requirements, which is normally only partly the case with embedded external interviews, and materials.
- We can also make sure that the interviews are conducted in a professional way from the researchers'

perspective. We selected semi-structured interviews as the research method, because this approach allows us to gain a deeper understanding of the relevant issues, and because this format allows some flexibility to address arising additional questions ad-hoc. Our moderation guidelines specifically cover topics like disaster experiences, impact on everyday lives, level of preparedness, and lessons learned from the disaster.

- Another reason for replacing embedded videos with our own content is the risk that the embedded material may be deleted, or the link may become obsolete, which would have a very negative impact on user experience (reduced usefulness and ease of use, frustration, lack of important information).

In the near future, it is planned to develop a multi-thematic platform that provides multimedia materials (videos, photos, eyewitness reports) on different types of disasters as open educational resources. To facilitate this, we are currently working on suitable classification schemes for multimedia content on disasters (based on e.g. disaster type, content, location, etc.).The goal is that multipliers like teachers, lecturers, or volunteer organizations can search for and download suitable risk communication materials in a targeted and easy way. One of the challenges that we are currently encountering is the wealth of information provided by disaster survivors. Some survivor interviews are approximately 40 minutes in length, and need to be broken down to more manageable bits of information. This is because it will usually be beyond the capabilities of lecturers and teachers to watch a long video just to extract some key snippets of 2 or 3 minutes for their class. Therefore, in a second step, the interview excerpts need to be tagged with metadata outlining their precise content, and relevance (e.g. disaster impact, long-term consequences, preparedness, early warning, etc.).

7 Conclusion and Outlook

This paper has shown that it is possible to develop new online risk communication materials as part of course assignments in universities. It was also demonstrated how online risk communication can appeal to different types of emotions, in order to improve learning and preparedness. Ongoing activities also show that elderly people who survived historic disasters are often eager to contribute, such as by participating in interviews, or by providing photos or films on disasters from their personal archives as part of citizen science projects. It was also observed that during the process of producing the required multimedia content, an intergenerational discourse on disasters was initiated (e.g., with elderly relatives of the students involved). Nevertheless, some challenges remain. As we plan to expand the initial concepts presented here into an international risk communication platform that will cover multiple types of disasters, new usability issues emerge. Content filtering of video materials, or multi-language requirements need to be addressed, for example. Another challenge is how to deal with copyrights, and personality rights issues related to private photo and film materials. This is particularly relevant if third persons appear on the photos or in the films. According to German personality laws, the consent of all persons pictured is required for the publication, at least if the persons are clearly identifiable, or not only a marginal part of the landscape.

However, since we are dealing with severe but rare disasters, it may not be possible to contact all these persons any more, such as because the people concerned have moved elsewhere or because they may have already deceased. Therefore, it may not be possible to obtain the informed consent of all relevant stakeholders for an online publication of some historic multimedia materials, so that publication may not be possible.

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