Humanitarian Toolbox Advanced Knowledgebase Search

by

Qingbei Shang

Maxine Shi

An Interactive Qualifying Project

Submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

in Computer Science

by

July 2021

APPROVED:

Smith, Therese

Abstract

The goal of this project is to do research on an Interactive Qualifying Project: Humanitarian Toolbox from Worcester Polytechnic Institute directed by Professor Therese Smith. Humanitarian Toolbox (HTBox) is a charity supporting disaster relief organizations with open source software and services. Maxine and Qingbei will demonstrate on their specific project called **2 Weeks Ready**, which helps people to be prepared for 72 hours before the natural disasters. We will doing the research on what people need after the natural disasters, such as Earthquakes, Tsunamis, Tornadoes, Hurricanes, and Forest Fires.

Keywords: Humanitarian Toolbox, Interactive Qualifying Project, natural disasters

Contents

List of Figures

Chapter 1

Introduction to Humanitarian Toolbox

Humanitarian Toolbox (HTbox) is a charity disaster relief organizations with open source and services, which demonstrates on using our skills in disaster relief aid through creating app. As a open source software, HTbox lifts barriers for contributors and users and makes it an ideal choice volunteer developers looking to make a difference and the organizations they need to help. Meanwhile, HTbox grants us this chance to contribute our effort and investigate more on the natural disasters, which we have never experienced before.

HTbox not only keep building the new software, but also on help maintaining the software. Many helpful custom software used in disaster relief becomes outdated or is not maintained after its initial use. HTbox applied their professional skills to keep the outdated software current and always improving. The projects that HTbox primarily involved with are those benefiting disaster relief organizations. The developers have started some projects from the scratch and worked closely with the organizations' leaders to building something unique. HTbox organizations would gather all the requirements and then break down into work items in GitHub; after that, they will run code-athons nad test-a-thons to get the software

written with the help of volunteers and continues to engage volunteers online via repositories.

The finished project of HTBox include:

1. **Mobile Kids ID APP**: An application for enabling storage and retrieval of important information oni missing children.

2. **Emergence Services Bot**: Bot application to supply affected individuals with important information in times of crisis.

3. **Crisis Check-in**: An application meant to capture, share and integrate the data around volunteers, and resources actively deployed into a disaster.

and current projects in progress include:

1. **Two weeks Ready**: most current, actively developed project focused on preparedness.

2. **All Ready**: an open-source solution focused on increasing awareness, efficiency and impact of preparedness campaigns as they delivered by humanitarian and disaster response organizations in local communities.

Humanitarian Toolbox related Website:

- Introduction: `http://www.htbox.org/about/our-vision`

- Github: `https://github.com/htbox`

Chapter 2

Natural Disasters Background

2.1 Earthquake

An earthquake is the shaking on Earth's surface, which causes a sudden release of energy in the Earth's lithosphere that creates seismic waves. Some earthquake are too weak to feel but some are violent to destruct the entire city. When the earthquake happens nearby offshore, the seabed may be displaced to cause a tsunami, which appeared in Japan during past years. Many earthquakes happened due to the rupture of geological faults but also by other events, such as landslides and volcanic activity. Based on our current technology, we can only record the earthquake's size, not forecast earthquake's coming. Thus, it is more important for us to be prepared before the earthquake, especially the earthquake-frequent area.

There are two types of preparedness for earthquake, enhancing survival and comprising actions. Enhancing survival includes preparing emergency supplies, such as first aid kit, water, a battery radio, and a torch; comprising actions includes fastening bookshelves and other heavy objects, or strengthening buildings to prevent them from collapsing [SMSW08]. However, these mitigation actions are not well-adaptable for earthquake preparedness. According to Spittal's research on Wellington,

New Zealand, he took in 63 area units as the basis for sampling participants. He used 23-item scale assess steps that people have taken to prepare for a major earthquake. The research indicated that "although risk propensity predicts survival actions, it does not predict mitigation actions, whereas the inverse relation is found with spheres of control. It is noteworthy that although numerous factor were measure and many of these correlate with preparedness, only two variables, home ownership and locus of control, predicted actions that mitigate damage"[SMSW08]. Their finding are important since public understanding on surviving in earthquake tends to be wrong.

2.2 Tsunami

A tsunami is a series of waves that can move rapidly in deep water, but fast for several hours. While they are not high in the sea, as they reach shallower water, the height have tsunamis can reach great height and caused grave damage to coastal cities. Tsunamis can be caused by a variety of geological processes such as earthquakes, landslides, volcanic eruptions, or even meteorites.

As it has been discovered that tsunami had less impact in ares where ecosystems were protected and local communities were aware of coastal hazards than those places with development very close to the shore line[SN08]. Prevention, education, and preparedness all are the foundation of disaster relief. In terms of prevention, being further away from shorelines is safer for visitors. It is also advised that cities preserve the local ecosystem to better combat the damage of tsunamis. For areas

prone to tsunamis, it is crucial to have education and preparation programs. In countries like Japan and Philippines which have large coastal regions that are susceptible to tsunamis, both offer tsunami education programs and national surveillance of the sea to warn its citizens[AK12]. These protocols are incredibly effective and cost-efficient in comparison to the damage that regions that do not have these programs suffer. The education programs focus on spotting early signs of tsunami, evacuation planing, and surviving until rescue.

Preparedness is the most difficult aspect to gauge in terms of disaster relief. There is always uncertainty surrounding true preparedness until one is in the face of danger. It is important since it will help the individual endangered in a tsunami.

2.3 Tornado

A tornado is a violently rotating column of air that is in contact with both the surface of the Earth and a cumulonimbus cloud. Tornado is dangerous since we cannot predict its moving; unlike other natural disaster listed here, people can see their formation and have a feeling what is going to happen. As Smith Ron described in journal, "You can't escape [tornado] because you can't be certain where they are going"[Ron]. With this unexpected movement, people do not have capabilities to gather all their belongings but finding the immediate shelter.

There is an average of more than 1,000 tornadoes occur each year in the United States according to National Center for Environmental

Information. From Professional Safety's interview with Jim Gustin, he addressed seven important points in his company's pre-emergency plan: shelter, supply, separation, safety, personnel (or visitors), drill, and inventory [Gus20]. Despite these seven factors happened during the tornado, people should be aware of their surrounding before the arrival of the tornado, such as checking weather alert, monitoring the trees, regular-checking the upkeep of buildings. and securing the outdoor storage units. People should have a thought on their proper destination when the tornado coming. A well-preparedness will mitigate the damage to the minimum.

2.4 Hurricane

A hurricane can also be called a tropical cyclone, which is a it type of storm that forms over tropical or subtropical waters. While hurricanes and tornadoes can appear to be similar, the size and time they last are big differentiators between the two. Hurricanes typically are hundred of miles in diameter and last for days or even weeks. Tornadoes usually lasts for a lot shorter and a lot smaller in diameter. Hurricanes can be tracked and predicted. This information is crucial for survival and damage control.

There are several ways that Hurricane relief is handled. Education, awareness, and timely relief are important for hurricane relief. Disaster education is very important since it was found that participation in some type of disaster education program is strongly related to the preparedness measures for hurricanes[KK10].There are predicted seasonal

hurricane for many coastal regions. Awareness is beneficial as the earlier one starts preparing the more prepared they will more likely be. It is crucial to formulate an evacuation procedure that identifies the threatened population, provides timely evacuation notice, identifies appropriate routes that maintains a safe distance from hazard[FKP92]. All of this is impossible without knowledge on the status of the Hurricane.

2.5 Forest Fire

Forest fire, or bush fire can be beneficial in the right time, but can wreak havoc, threatening lives, communities, and natural resources in the wrong place at the wrong time. In terms of large scale forest fires, they can be difficult to put out once they start. Ever

For areas like California always facing forest fire, the Forest Service have developed and implemented a new strategy that involves the key step of: prevention, precaution, and effective response. Targeted initiatives are also a tool to create a proactive culture of preparedness and safety[WRBT20]. Prevention mainly comes in the form of preventing unnecessary and in the forms of controlled burns. The recent spike in wild fires is also caused by historic suppression of naturally occurring wildfire. Naturally occurring wild fires can clear underbrush, prevent overpopulation and promote growth for certain species. Thus, regulated burns are important in preserving the natural forests. Precaution focuses on surveying the temperature and the condition of the forest. With the current escalation of the severity of forest fires, it has forced many areas to create large scale evacuations[VGF+18]. This is important to prevent

the loss of lives both for the animals and for the residents affected.

Chapter 3

Our Approach

After researching the topic of different natural disasters, one can come to the conclusion that when facing the natural disasters, preparedness is extraordinarily important. With thorough preparation, people can mitigate the damage and keep themselves in safe area. Natural disasters are avoidable, especially earthquake and tornado are unpredictable and unavoidable.

Natural disasters have lots of factors that are uncontrollable; thus, having application for preparedness is necessary, which is what Humanitarian Toolbox demonstrates. The current project of Humanitarian Toolbox, 2 Weeks Ready, helps people to create plans for each other in the community to stay safe until first responders can reach them. Using the application means the user will be prepared to become two weeks ready, which is the average time it takes first reponder to reach natural disaster victims.

Through studies we have analyzed, it can be confirmed that one should take a proactive approach when facing a potential natural disaster. It is better to be prepared for something that did not happen than to be not prepared for something that happened.

Nowadays, we have more advanced technology that help us predict the natural disasters and/or send us alert to be aware of upcoming natural disasters. For example, we now can receive the weather alert on our phone, which warning us to hide in the shelter before the hurricane's arrival; however, there is still a place for applications that take this more proactive approach and focus on pre-disaster preparations. This can also be more realistic since in the

The Two Weeks Ready application takes a different approach in comparison to traditional disaster relief application. The Two Weeks program focuses on preparing people in case of emergency, which is a proactive approach that will be beneficial regardless of the type of natural disaster one is facing. Additionally, the program accounts for many different type of disaster and even takes children and pets into account. This is excellent as pets are often a point of concern for people making decisions in the face of danger.

Chapter 4

Our Work

In terms of precisely how we are going to improve disaster relief, we plan to contribute to the open-sourced program Humanitarian Toolbox, which includes the contribute to the in-progress project and translate the website for people to understand the goal of HTbox.

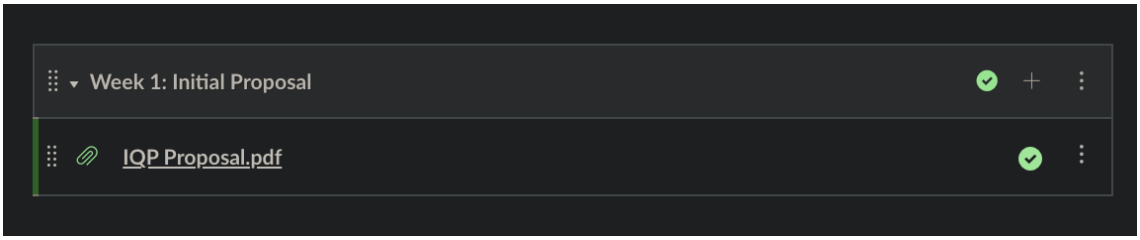

Figure 4.1: Week 1 Progress

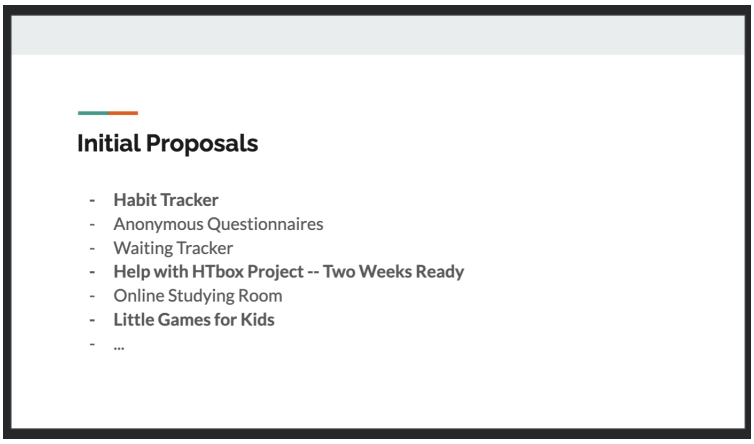

Figure 4.2: Our initial Proposal

For this 7-week project, we started with the construct the proposals about what we can do help people (Figure 4.1). Our initial brainstorm resulted in three ideas that seemed achievable and helped a community of people. We then chose to focus on environmental hazard (Figure 4.2).

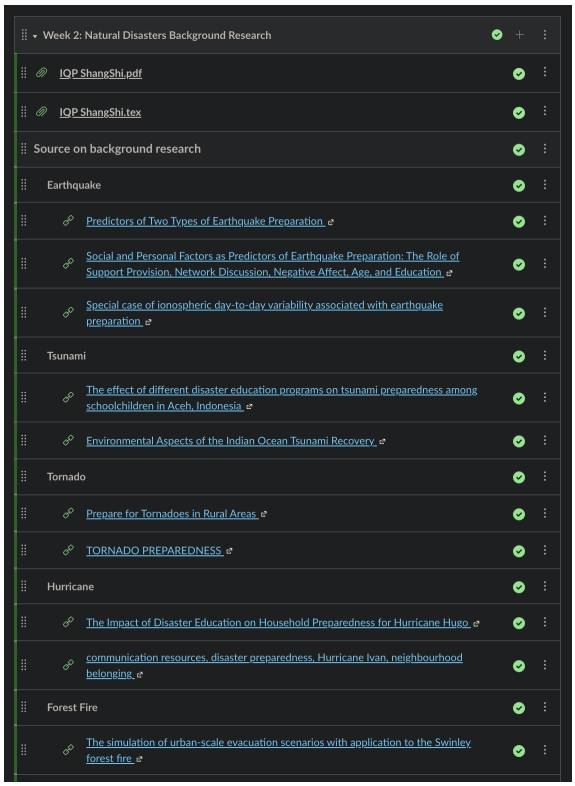

Figure 4.3: Week 2: Research on Natural Disasters

For the second week, we conducted background research on different natural disasters. This included researching about disaster prevention, relief and post-disaster rebuilding for the most commonly occurring natural disasters: earthquake, tsunami, tornado, hurricane, and forest fire (Figure 4.3).

Logically, we proceeded to organized all the sources that was researched in Week Two during Week Three. This means thoroughly ana-

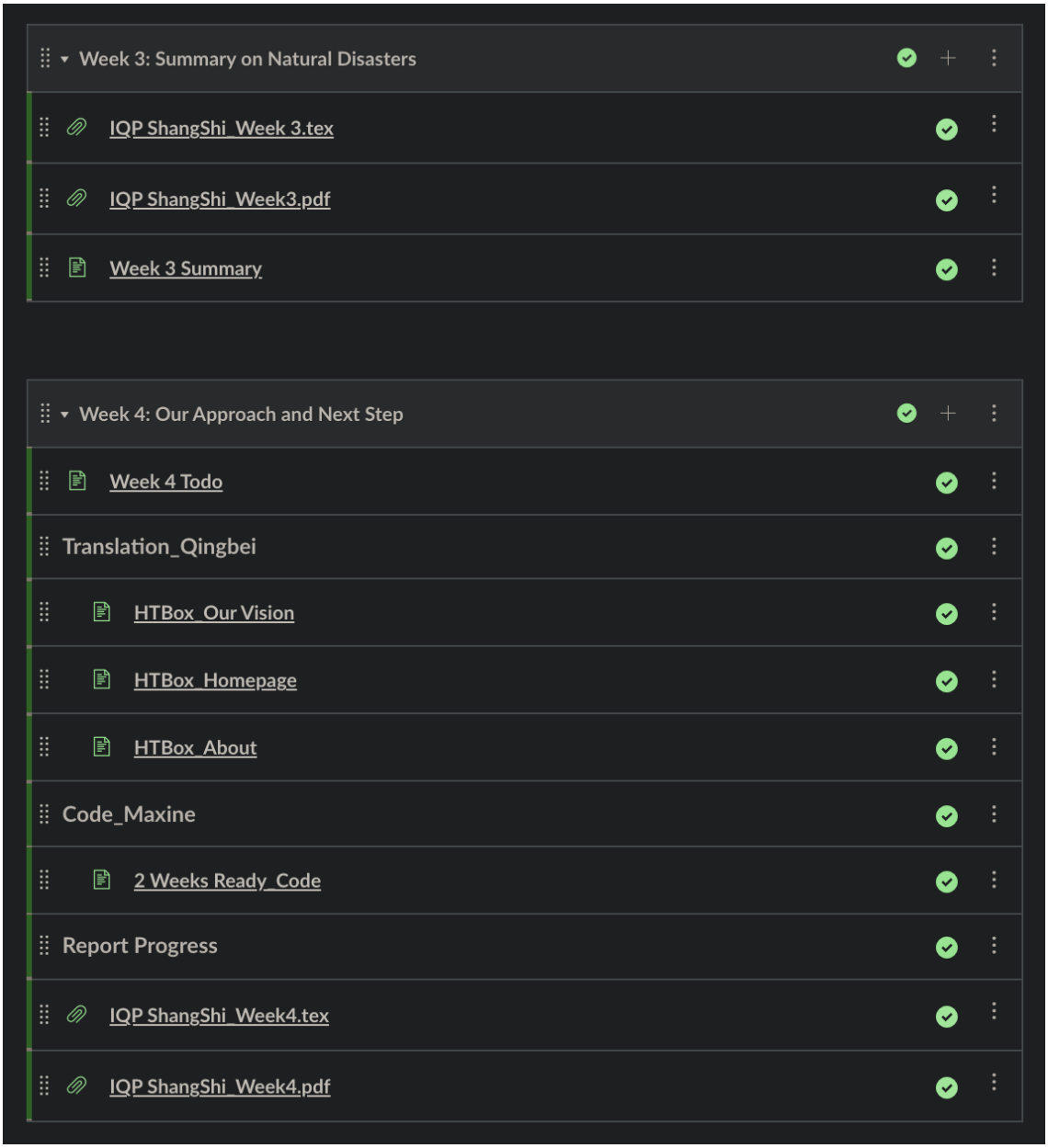

Figure 4.4: Week 3 and 4: Conduct Summary, Our Approach and Next Step

lyzing the research papers and creating summaries for each natural disaster. This progress drew our attention on how many people cannot escape from the natural disasters due to the unpreparedness. When we drafted the summary, we noticed that many people preparation is in the wrong direction.

During week 4, we came to terms with how we will contribute to disaster relief and chose to work on different aspects of the HTBox, specifically the Two Weeks Ready program that focused preparing people to face natural disaster and survive. For Qingbei, this meant deciding to translate the main website of the HTBox Program for the team to reach a larger audience. For Maxine, this meant reading through the project plan of the TWR Program and deciding how to contribute to the code. (Figure 4.4)

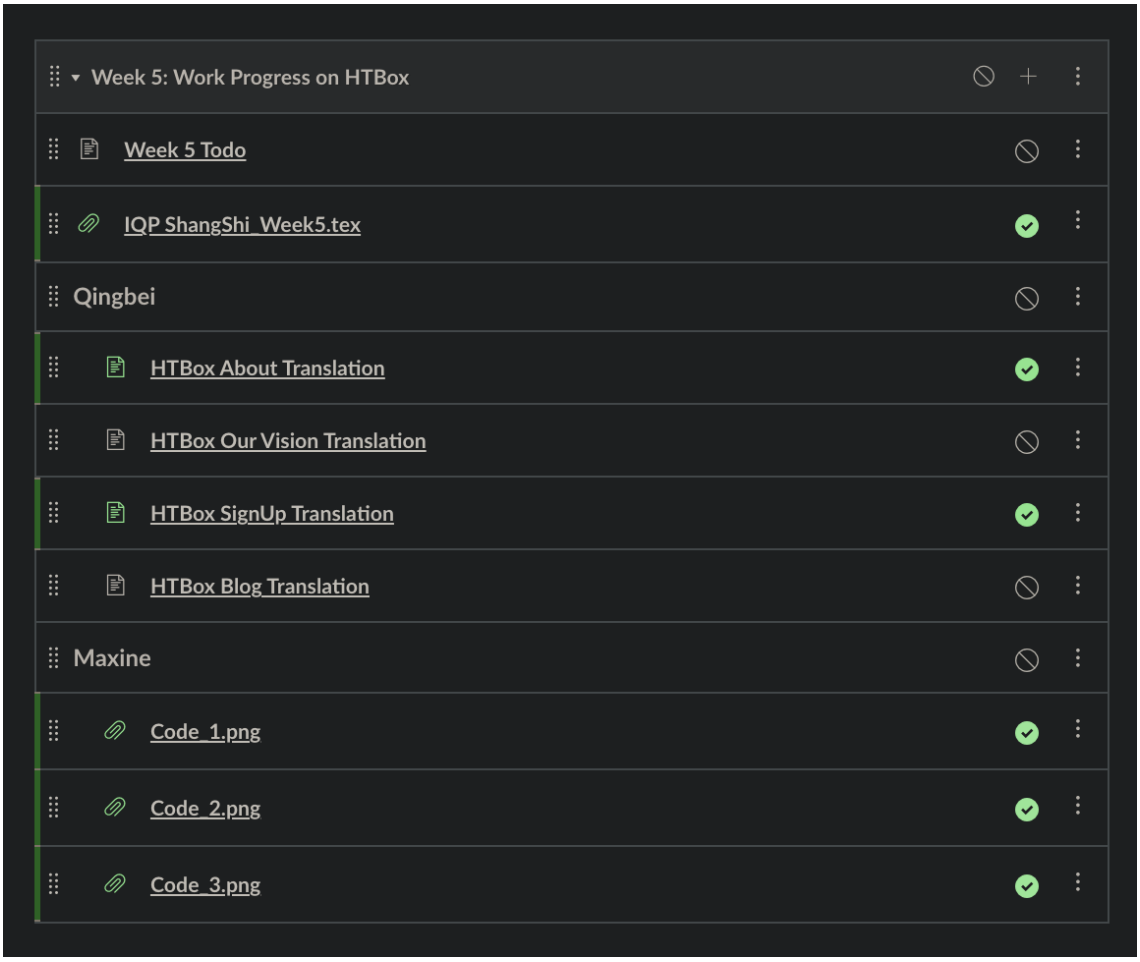

Figure 4.5: Week 5: Our Work

Figure 4.6: Translation for HTBox's About Website

Figure 4.7: Translation for HTBox's Our Vision Website

Figure 4.8: Translation for HTBox's SignUp Website

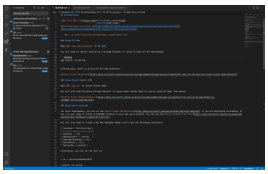

Figure 4.9: The Code for the Emergency Kit

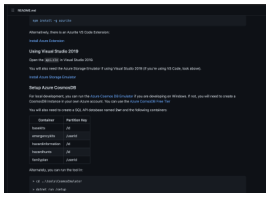

Figure 4.10: Setting up VSS Code

Figure 4.11: Setting Up CosmosDB

As for week 5, following the decision of how to contribute to the TwoWeeksReady Program, we started the tasks that was planned. Qingbei began translating the introduction page of the site. (Figure 4.6, 4.7) Maxine looked for specific functionality of the 2Weeks code that she can improve upon. (Figure 4.5)

In conclusion, we downloaded HTBox's source code and modified them. Unfortunately, we did not have the response from HTbox organizers, which means that we cannot upload our achievement on their Github. There are few things we are unable to achieve without their

permission; for example, we cannot locate their English script from their source code, which causes us only translating on our side without implementing on the source code. Overall, we finished the translation on the core pages and looked into the details of TwoWeeksReady program. We are happy about participating in this project to help more people to prevent, relief, and survive in the natural disasters.

Bibliography

[AK12] Wignyo Adiyoso and Hidehiko Kanegae. The effect of different disaster education programs on tsunami preparedness among schoolchildren in aceh, indonesia. *Disaster Mitigation of Cultural Heritage and Historic Cities*, 6(1):165–172, 2012.

[FKP92] CE Faupel, SP Kelley, and T Petee. The impact of disaster education on household preparedness for hurricane hugo. *International journal of mass emergencies and disasters*, 10(1):5–24, 1992.

[Gus20] Jim Gustin. Tornado preparedness. *Professional safety*, 65(2):51–52, 2020.

[HAG+05] Kenneth Heller, Douglas B Alexander, Margaret Gatz, Bob G Knight, and Tara Rose. Social and personal factors as predictors of earthquake preparation: the role of support provision, network discussion, negative affect, age, and education 1. *Journal of Applied Social Psychology*, 35(2):399–422, 2005.

[KK10] Yong-Chan Kim and Jinae Kang. Communication, neighbourhood belonging and household hurricane preparedness. *Disasters*, 34(2):470–488, 2010.

[PKCP07] SA Pulinets, AN Kotsarenko, L Ciraolo, and IA Pulinets. Special case of ionospheric day-to-day variability associated with earthquake preparation. *Advances in Space Research*, 39(5):970–977, 2007.

[Ron]

[SMSW08] Matthew J Spittal, John McClure, Richard J Siegert, and Frank H Walkey. Predictors of two types of earthquake preparation: survival activities and mitigation activities. *Environment and Behavior*, 40(6):798–817, 2008.

[SN08] Hari Srinivas and Yuko Nakagawa. Environmental implications for disaster preparedness: Lessons learnt from the indian ocean tsunami. *Journal of Environmental Management*, 89(1):4–13, 2008. Environmental Aspects of the Indian Ocean Tsunami Recovery.

[VGF+18] Anand Veeraswamy, Edwin R. Galea, Lazaros Filippidis, Peter J. Lawrence, Simo Haasanen, Robert J. Gazzard, and Thomas E.L. Smith. The simulation of urban-scale evacuation scenarios with application to the swinley forest fire. *Safety Science*, 102:178–193, 2018.

[WRBT20] Rachel Westcott, Kevin Ronan, Hilary Bambrick, and Melanie Taylor. Natural hazards and adaptive response choices in a changing climate: Promoting bushfire preparedness and risk reduction decision-making. *Social Sciences Humanities Open*, 2(1):100065, 2020.