Understanding Disaster Related Information-Seeking Behavior Using Oral Documents

Rahmi

Graduate School of Library, Information and Media Studies
University of Tsukuba

August 2015

Understanding Disaster Related Information-Seeking Behavior Using Oral Documents

Student No.: 201325003
Name: Rahmi

The 2011 Great East Japan Earthquake was one of the largest earthquakes ever recorded in Japan's history. Catastrophes destroy many critical infrastructures. Immediately, people experiences information disruption within their community, as well as between the outside world. The inability of communication due to physical or virtual barriers instigates instant isolation. Therefore, understanding how individuals sought for information during such a disaster situation is a very important topic in Crisis Informatics.

We present datasets and findings from the analyses of three oral documents which include the published records of local governments, power companies, news media, and local people. We examine two datasets; timeline datasets and behavior datasets. Timeline consist of 353 annotations to analyze information pathways such as information flows and dissemination. A total of 376 annotation was identified to examine information needs, sources and channels of local people's information seeking behavior during event. Oral documents gave us a richer contextual description of information-seeking behavior during the disaster, when compared to online activity analysis such as Twitter.

Our findings shows many of the disaster-related information-seeking challenges include the relative importance of passive and active information needs, channels, and sources. People experiencing of uncertainty due to a lack of specific information through many devices. While official, authoritative sources are important. the 2011 Great East Japan Earthquake and Tsunami showed that informal, trusted social sources such as family, friends, and neighborhoods are often more critical as the first sources of warning information that is relevant to the location and circumstances of the local resident. Therefore, residents act as information sources as well as information seekers. Although most of our findings is based on a small sample skewed toward regional areas and were selected by convenience sampling methods, it added new insights into the disaster-related information-seeking behavior. A longitudinal study is required to confirm or refute findings.

Academic Advisor: Principal: Hideo JOHO
Secondary: Tetsuya SHIRAI

Table of Contents

Abstract 2

Table of Contents 3

List of Figures 5

List of Tables 6

1 INTRODUCTION 7

1.1 Research Background 7

1.2 Aim and Objectives 10

1.3 Brief Description of Methodology 11

1.4 Thesis Outline 12

2 LITERATURE REVIEW 13

2.1 Information Seeking Behavior in General 13

2.1.1 Everyday Life Information Seeking (ELIS) 14

2.1.2 Information Seeking Behavior in Disaster 14

2.2 Data Sources 17

2.2.1 Social Networking Sites 17

2.2.2 Oral Documents 19

2.3 Information Transmission in Japan 22

3 METHODOLOGY 25

3.1 Research Context 25

3.2 Collection of Documents 26

3.2.1 Timeline Datasets 27

3.2.2 Behavior Datasets 30

4 RESULT 40

4.1 Timeline Datasets Findings 40

4.1.1 Temporal Model 40
4.1.2 Information Flows 42
4.2 Behavior Datasets Findings 43
4.2.1 Basic Demographic Characteristics 43
4.2.2 Channels vs. Passive Needs and Active Needs 45
4.2.3 Sources vs. Passive Needs and Active Needs 49
4.2.4 Passive/Active Channels vs. Sources 53

5 DISCUSSION 56
5.1 Temporal Descriptions to Transmit Disaster… 56
5.2 Comparison with the Framework 59
5.2.1 Information Needs 59
5.2.2 Information Channels 61
5.2.3 Information Sources 62
5.2.4 Information Seeking 63
5.3 Limitations 65

6 CONCLUSION 67
6.1 Conclusion 67
6.2 Further Research 67

Acknowledgements 69

List of References 70

List of Figures

Figure 1.1 Ring of Fire 7

Figure 2.1 Savolainen's information source horizon and… 16

Figure 2.2 The Tsunami Warnings and the Evacuation Instruction… 23

Figure 3.1 Timeline datasets sample on *Daishinsai Dokyumento*... 27

Figure 3.2 Example timeline annotation… 28

Figure 3.3 Eight Socio-Temporal Stages of Disaster 29

Figure 3.4 Data Presented with Timeline on SIMILE Widgets 30

Figure 3.5 Location of North Ibaraki, Ibaraki Prefecture &… 31

Figure 3.6 Kappa's calculation on 376 annotations 33

Figure 3.7 Behavior datasets sample on North Ibaraki Disaster Diary 34

Figure 3.8 Example of Behavior Annotation 39

Figure 4.1 Two Temporal Stages, Warning and Threat 40

Figure 4.2 Number of annotations related to the phases of disaster 40

Figure 4.3 Information Flows Tsunami Warnings and… 41

Figure 4.4 Channels vs. Passive Needs and Active Needs 46

Figure 4.5 Sources vs. Passive Needs and Active Needs 52

Figure 4.6 Passive/Active Channels vs. Sources 55

Figure 5.1 Information dissemination with electricity and without… 58

Figure 5.2 Arai's model on Information dissemination 59

List of Table

Table 4.1 Gender distribution on the oral documents' transcript 44

Table 4.2 Age distribution on the oral documents' transcript 44

Table 4.3 Passive information needs and channels type 48

Table 4.4 Active information needs and channels type 49

Table 4.5 Passive information needs and sources type 50

Table 4.6 Active information needs and sources type 51

Table 4.7 Information channels and sources on Passive Needs 53

Table 4.8 Information channels and sources on Active Needs 54

Chapter 1
INTRODUCTION

1.1 Research Background

Earthquakes and related natural disasters are always a possibility for anyone who lives or works in areas along the Pacific Rim, so called, “Ring of Fire” (Weisenfeld, 2012). Major disasters such as 2004 Indian Ocean Earthquake and Tsunami (Cummins, et. al., 2009) and the 2011 Great East Japan Earthquake and Tsunami constitute a ripe domain for information-seeking behavior concerns, as they involve collaboration among individuals, organizations and society as a whole. Disaster situations, throughout history, have demonstrated that people rise to difficult challenges to help others, often through remarkable innovations and adaptations of their own abilities and resources to meet needs (Tierney, Lindell and Perry, 2001; Kendra, Wachtendorf and Quarantelli, 2003).

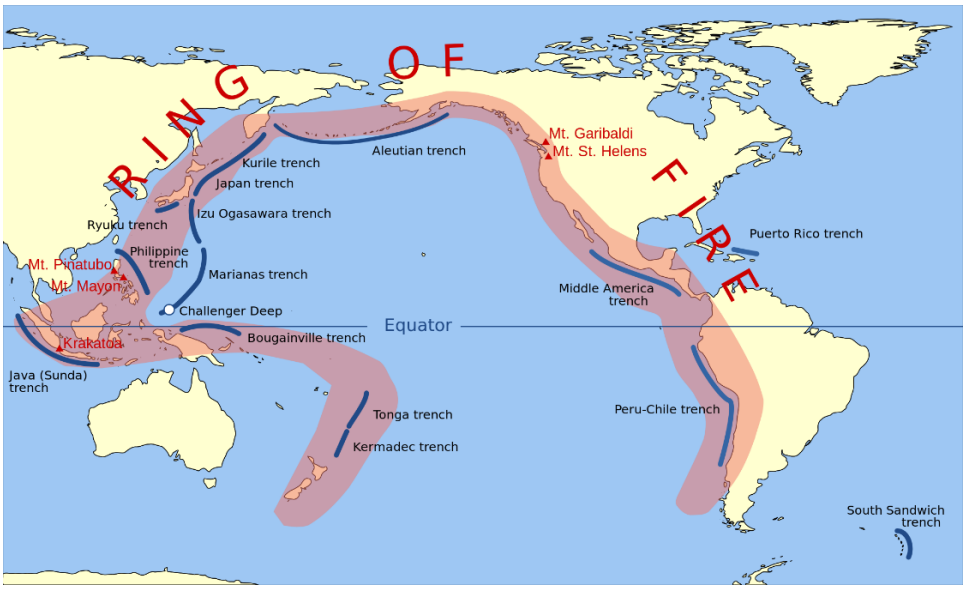


Figure 1.1 Ring of Fire

Source : http://en.wikipedia.org/wiki/Ring_of_Fire

The lives of many people are altered forever when they are caught up in an unexpected disaster in their physical environment. Formally, we can define such disaster event as a temporally acute, unanticipated natural or manmade disaster (Imran et. al., 2013). In some settings, citizens and governments can seek to prepare for the occurrence of crisis events, for example, planning for earthquake response in geologically active areas. Such planning can involve response preparation for individual citizens and emergency services. Unfortunately, however detailed such plans are, the exact response required will be unknown and each event involves unique circumstances. Two things that are certain though are the response and timely collection of relevant information. The response needs to be prompt, often very prompt. Thus, timely collection, collation and distribution of relevant information to all those caught up in a disaster event is also important. Those are key to limiting immediate distress, suffering and loss of life, and potentially the long-term effects on individuals and their environment.

Taking the case from the 2011 Great East Japan Earthquake and Tsunami, it triggered powerful tsunami waves that reached heights of up to 40.5 meters (133 ft) in Miyako in Tohoku's Iwate Prefecture, on March 11, 2011 at 14:46:24 JST (UTC +09:00)[1]. It reached a magnitude of 9.0 on the Richter scale and lasted for 6 minutes; it is considered the fourth most powerful earthquake in the world since modern record-keeping began in 1900[2]. Nearly 16,000 people were reported dead and 2,500 people missing after the disaster and more than 6,200 million people were affected in some way[3].

The Great East Japan Earthquake on 2011 was one of the largest disaster ever recorded in Japan's history and destroy many critical infrastructures.

[1] Reilly, Michael (11 March 2011). "Japan's quake updated to magnitude 9.0". *New Scientist* (Short Sharp Science ed.). Archived from the original on 5 April 2011. Accessed on 30 April 2015.

[2] "New USGS number puts Japan quake at 4th largest". *CBS News*. Associated Press. 14 March 2011. Archived from the original on 5 April 2011. Accessed on 30 April 2015

[3] "Damage Situation and Police Countermeasures... 11 March, 2015" National Police Agency of Japan. Retrieved 12 March, 2015. Accessed on 30 April 2015.

Immediately after disaster happened, people experiences information disruption within their community, as well as between the outside world. This inability to access information caused by physical or virtual barriers instigates instant isolation (Arai, 2013).

A small number of studies have been undertaken around the world on how people seek for information in a disaster. Most of the research have focused on what media sources people use (Greenberg, Hofschire and Lachlan, 2002; Piotrowski and Armstrong, 1998; Roeser and Schaefer, 2002; Seeger et. al., 2002; Stempel and Hargrove, 2002). This type of study on information-seeking provides data on which better communication plans can be built by emergency agencies.

First study that we found on Information Seeking Behavior (ISB) in a disaster was conducted by Barbara Ryan (2013) based on a flood in Queensland, Australia from 2010 to 2012. This study informed agencies to look at how individuals sought for information, the channels they use to get information and the type of information they seek. To analyse it, she compared her findings with the framework of the information-seeking model by Savolainen (1995; 2008). Unfortunately, this research did not include other types of natural disaster such as earthquake and tsunami.

Apart from the concept of information-seeking behavior, we need to know what data sources that we will use. With increasingly pervasive information and communications technology (ICT), the people's attention to disaster situation is high. People generally need the disaster information to overcome with the problem that might be happen. Therefore, people often get this information through on-line activities. A large number of research have investigated information-seeking behavior across social networking service or on-line activities (Tapia, A., et. al., 2011). Unfortunately, however, many people did not have any access to face to face communication. Furthermore, researcher tend to analyze disaster information propagated through Twitter network with the purpose of assessing the reliability of

Twitter as an information source. Their analysis shows that the propagation of tweets that correspond to rumors from tweets tend to be questioned (Mendoza et. al., 2010). It leads us to say that social media data can also be problematic. For example, a United Nations study of the potential of social media, "While they (social media and microblogging) make available information that would not have emerged otherwise, they pose a serious challenge in terms of authentication. Validation is a fundamental issue in the further use of social media in situations of conflict and disaster" (Coyle, et. al.,2009).

In this study, we use different data resources. There is another resources than online or social networking sites data which we known as oral documents. Turner (2007) defined oral documents as an evidence or information about both specific content and characteristics embedded in action(s) essential to furnishing that content via word of mouth spoken in the presence of another. Given that, we specifically consider about the ways in which oral documents mediate our vision and understanding of disaster rather than using online arenas. This new sources offered fascinating echoes of the earlier earthquake and insight of the earlier earthquake.

In addition, having just completed less than two years of research on the devastating 9.0 magnitude earthquake, tsunami and hundreds of strong aftershocks that flattened East Japan and surrounding areas on 2011, perhaps we can gain more understanding on this topic compared to other large-scale disasters. We specifically consider the challenge of studying disaster related information-seeking behavior using oral documents during The 2011 Great East Japan Earthquake and Tsunami.

1.2 Aim and Objectives

This research objective is to understand the situation about how individuals seek for information, the sources and channels they used to get information and the

type of information they seek. It will give us a richer contextual description of information-seeking behavior during the disaster, when compared to online activity analysis such as Twitter.

We present datasets and findings from published records of local governments, power companies, news media, and local people. We extracted two types of data from oral documents (i) Timeline datasets and (ii) Behavior datasets. First, we characterize the usage of oral documents of the days immediately after the event using timeline datasets. The goal of this task is to observe how temporal stages of disaster phases are propagated and the dynamics of the information flows and dissemination. Second, we investigate the behavior datasets to discuss local people's information needs, information seeking, and information sources and channels during the 2011 Great East Japan Earthquake and Tsunami. To sum up, this research should help, guide, and plan information access technologies for better planning of disaster supporting system and policies.

1.3 Brief Description of Methodology

To investigate the information-seeking behavior patterns in disaster particularly, six reports (oral documents) used as a primary data collection. We will verify data by open coding to develop a grounded theory model of their consistent pattern of information seeking behavior. Creswell (1998) explains that "The centerpiece of grounded theory research is the development or generation of a theory closely related to the context of the phenomenon being studied". Furthermore, Charmaz (2014) clearly describe how documents can be used as data,

"Grounded theories of documents can address form as well as content, audiences as well as authors, production of the text as well as presentation of it." Further explanation will be shown in chapter 3, Methodology.

1.4 Thesis Outline

The remaining of the work is organized as follows:

Chapter 2 presents a literature review concerning the concept of information-seeking behavior in general, information-seeking behavior in disaster and data sources type such as social networking network and oral documents. Chapter 3 discuss about research methodology. Results of the data analysis are presented in Chapter 4 and discussed in Chapter 5. Chapter 6 includes the conclusions of this thesis, which are followed by several suggestions for further research.

Chapter 2
LITERATURE REVIEW

This chapter will begin with a review of information-seeking behavior in general, after which, we part into two sub-chapter, everyday life information seeking (ELIS) and information-seeking behavior in disaster. Then, we will explain two concepts of data sources such as social networking sites and oral documents. Finally, we survey the concept of information transmission in Japan.

2.1 Information Seeking Behavior in General

Research in the area of human information behavior has been advantageous in the past few decades, moving beyond a resource-focused to a person-centric perspective (Clemens and Cushing, 2010). Many descriptive models characterize complex relationships among a person's perceived information need, cultural and situational contexts, information resources, systems and intermediaries (Clemens and Cushing, 2010). Theories of information behavior often address cognitive influences such as problem-solving, mental models, and affect heuristics (Wilson, 2000; Savolainen 1995; 2008). Situated under the umbrella concept of information behavior is the more historical notion of information seeking behavior defined as,

> "The purposive seeking for information as a consequence of a need to satisfy some goal" (Wilson, 2000).

Information seeking behavior research is traditionally partitioned into two realms of life experiences: 1) work or job related; 2) everyday life information seeking (Savolainen, 2010). These two spheres encompass a significant share if not majority of life's time and effort at the universal level.

We use examples from lived experiences to explore the scope of everyday life information seeking (ELIS), through people who experience 2011 The Great East Japan Earthquake and Tsunami. Situations like these have profound impact on the focal person; perceived information needs and search strategies directly affect processes of decision making, coping, and understanding of one's self.

2.1.1 Everyday Life Information Seeking (ELIS)

The concept of everyday life information seeking (ELIS) is widely used in constructing research frameworks of information behavior. As Savolainen (2010) explains,

> "The key word is everyday life, which refers to a set of attributes characterizing relatively stable and recurrent qualities of both work and free time activities. The most central attributes of everyday life are familiar, ordinary, and routine" (Savolainen, 2004).

Within the sphere of ELIS several influential models of information behavior exist including Dervin's sense-making approach (1992), Bates' berrypicking (1989), Chatman's small world concept (2000), Pirolli and Card's information foraging (1999), Williamson's ecological model (1998), Wilson's problem solving model (1999) and Fisher, Durrance and Hinton's (2004) information grounds. But what happens when we step outside the realm of the everyday? Consider a personal crisis such as disaster situation.

2.1.2 Information Seeking Behavior in Disaster

Information seeking behavior (ISB) research was not seriously undertaken until the World Trade Center (WTC) attacks in United States with most literature to that point focusing on media or web usage rather than information networks as a

whole (Ryan, 2013). There is also far more literature on disaster warnings than post-impact communication or information seeking.

However, 11th September changed all that, with a number of very good studies undertaken within two months of that disaster in the US by university-based researchers. Then came a series of projects sponsored by the Centers for Disease Control in which focus group respondents were presented with scenarios on bioterrorism, and terrorism involving radioactive materials. In these studies, people were asked to outline their information seeking pathways and also to recount their feelings about what was happening, confirming a link between information seeking rates and anxiety levels (Ryan, 2013).

In Japan, some studies had been conducted about information behavior concerning the 2011 Great East Japan Earthquake. Gomez (2013) carried out an interesting study about international students' reaction to the 2011 Great East Japan Earthquake at Tohoku University. Arai (2013) worked on the linguistic perspective on Japan's tsunami warnings and evacuation instruction. However, these covered wider topics than information seeking, producing a few gems related to the topic within each study. Apart from this, a small number of studies have investigated information-seeking across all available sources of information such as oral documents during a disaster or on the channels that people use to secure information (Fu et. al. 2010; Priest et. al., 2006; Quarantelli, E L., 1990).

Ryan's (2013) work on Information Seeking Behavior in a flood looked at how individuals look for information, the channels they use to get information and the type of information they seek during flood incidents. The framework for the study related to seeking problem-specific information and the information-seeking model proposed by Savolainen (1995; 2008) and shown in Figure 2.1. Ryan (2013) also explained that people in cities tend to find out about disasters occurring in their own community through interpersonal contact via variety of media such as mobile and fixed phones and face to face. On the other, young people are more likely to

use social media (American Red Cross, 2011; Lachlan, Spence & Nelson, 2008). People in urban areas are more likely to use television, particularly women. Women are more also likely to use the internet (Lachlan, Spence & Nelson, 2008) although Spence et. al., (2006) found men more likely to use the internet in the aftermath of 11th September. Therefore, the relationship between internet user will gender is not clear.

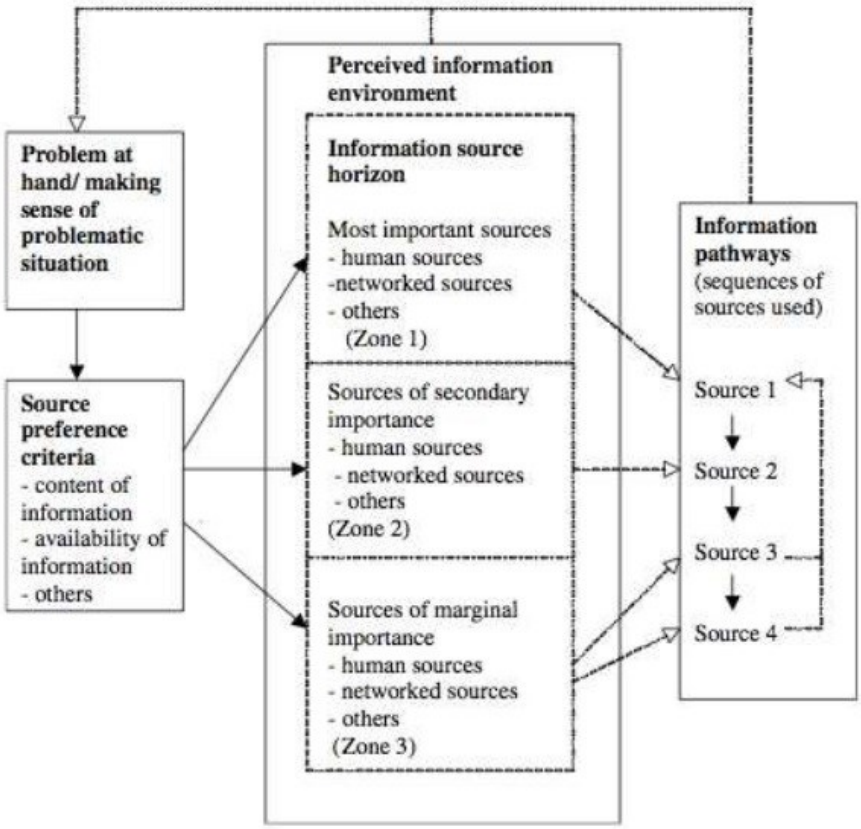


Figure 2.1 Savolainen's information source horizon and information pathways in the context of seeking problem specific information (Savolainen, 2008)

People in regional areas serviced by small rural towns tend to use personal agency contacts where possible and were more likely to use family, friends and knowledgeable acquaintances (Hagar 2010), as well as local radio stations (Cohen, Huges & White, 2007). In Goudie and King's study of a regional North Queensland flood (1997), own observation was the most prevalent way to get information. Hughes et. al., (2007) discovered that radio and personal contacts in emergency

agencies were the preferred sources of information in a bushfire. With this view, we are aware that the type of disaster determines how people seek for information.

To sum up, a small number of studies have investigated information seeking across all available sources of information during a disaster or on the channels that people use to secure information during the 2011 Great East Japan Earthquake and Tsunami.

2.2 Data Sources

Disaster and crisis phenomena, including natural and man-made disasters (e.g., hurricanes, tsunamis, resource conflicts and genocide) as well as intentional or accidental hazards (e.g., terrorist bombings, chemical spills) require a coordinated response among a variety of people, organizations, channels, sources, and have severe consequences for the safety of communities. Society has always had to manage these crises, but with the proliferation of networked technologies, researchers have begun to focus on the constituent elements of networks, with the eventual aim of leveraging the power of network elements in providing information as a way of mitigating the impacts of and speeding up the recovery from extreme events (Maitland, et. al., 2007; Maitland, et. al., 2009; Maldonado, et. al., 2009; Ngamassi, et. al., 2010 and Tapia et. al., 2009). Here, we explore two examples of data sources.

2.2.1 Social Networking Sites

Social media usage has been increasing over time (Alliance Strategic Research, 2011; Vieweg, et. al., 2010), and the American Red Cross's study recorded that one in six people from the general population (as opposed to the online population) used social media to get information on a disaster (American Red Cross,

2011). The age and gender differences noted by Lachlan et. al., (2008) and the American Red Cross were also recorded by Spence et. al., (2006) and Hayward et. al. (2010). For example, younger people turned to the web and newspapers for information (Spence et. al., 2006).

As social networking sites become more integrated into the daily lives and everyday communication patterns of much of the developed world, the scholars of disasters and emergency response see hope in these practices. The existence of over four billion cell phones throughout the world, coupled with information sharing sites such as Facebook, Twitter, and virtual universal connectivity, provide the technological basis for worldwide information collection, sharing and dissemination (e.g., Jansen et. al., 2009). These microblogging practices are often described as rich sources of timely data that may offer affected individuals and responders valuable information. Palen, et. al., (2010) argues that social networking sites used around crises involves self-organizing behavior that can produce accurate results, often in advance of official communications. On the other hand, much has been written concerning the value of using messaging and microblogging data from crowds of nonprofessional participants during disasters (Palen, et. al., 2008; Palen, et. al., 2009; Sutton, et. al., 2008; Vieweg, et. al., 2008). Data produced through microblogging is seen as ubiquitous, rapid and accessible (Vieweg, et. al., 2010), and it is believed to empower average citizens to become more situationally aware during disasters and coordinate to help themselves (Palen, et. al., 2010).

In this study, we use different data resources, known as oral documents. Turner (2007) defined oral documents as an evidence or information about both specific content and characteristics embedded in action(s) essential to furnishing that content via word of mouth spoken in the presence of another. Given that, we specifically consider about the ways in which oral documents mediate our vision and understanding of disaster rather than using online arenas. This new sources offered fascinating echoes of the earlier earthquake and insight of the earlier earthquake.

2.2.2 Oral Documents

This part presents a working definition of an oral document and articulating the concept of an oral document provides a useful strategy for increasing disciplinary knowledge about oral information. In pursuit of the broader goal, this part addresses a question: can information conveyed orally incorporate properties of a document?

Definitions of a document reflect its widely recognized characteristics of providing evidence (Briet, 2006), as in proof, and of being informative (Buckland, 1991). However, Frohmann (2004, 2007) argues that relying solely on a definition to articulate a concept has limitations. Doing so, restricts the formation of new knowledge (Frohmann, 2007). In Buckland's classic work (1997), he weakens the traditional notion that a document must be a textual record by describing how a "documentalist increasingly emphasized whatever functioned as a document rather than traditional physical forms of documents" (Buckland, 1997). This assertion follows his earlier observation that people can be informed by objects, events, and intentional communiqués (Buckland, 1991). Numerous document studies scholars explain that a document can be identified with a definition or by noting practices that provide evidence or make it possible to become informed (Buckland, 1991; Buckland, 1997; Day, 1997; Briet, 2006; Frohmann, 2004). Identifying a document by noting practices used to create it means considering how it can be informative (Buckland, 1997; Stornetta, 1992). Findings in another area of information science, information behavior, provide insight into practices used to obtain information.

Scholars repeatedly acknowledge that people prefer to obtain information by talking (Case, 2007; Mackenzie, 2005; Turner, 2009). Moreover, obtaining information while talking face-to-face persists despite the availability and proliferation of technology (Meehan, 2000; Sole and Edmondson, 2002). Several scholars suggest that orality is preferred when accessing new information (Auter and Choo, 1993; Daft and Lengel, 1983; Fidel and Green, 2004; Mackenzie, 2005).

This suggestion implies that one method for discovering new information lies in identifying substantive comments conveyed orally. This implication is strengthened by how information science scholars have increasingly relied on a new theoretical perspective, social constructionism. According to this meta-theory, contributions to knowledge are made in writing, through actions (or practices), or by talking (Mackenzie, 2005; Talja et. al., 2005).

The main contribution of Turner's work (2007) lies in presenting a method for analyzing utterances to determine the information that they convey. The method stems from the following discussion of the informative nature of documents. Document studies literature provides insight into identifying a document by practices used to become informed. Frohmann (2004) refers to the properties of a document as evidence of practices that render a document informative. He identifies four properties that shape and configure the informative nature of documents as much as they describe documentary practices (Frohmann, 2004).

First, the institutionalization property refers to how documents adhere to institutional norms and influence institutional processes in ways that perpetuate or reinforce a context (Frohmann, 2004). For example, a statement that addresses someone using the term, "your Honor," refers to and perpetuates the legal context. Next, the social discipline property ensures documents can be perpetuated, given changes in a context over time (Frohmann, 2004). The social discipline property involves assuring that appropriate persons are trained to re-produce and oversee the processes of re-creating a document (Frohmann, 2004). A document that incorporates detailed pedagogical knowledge provides evidence that its creator is an experienced educator trained in providing curricular documents.

The third property, historicity, examines how documentary practices are changed and adapted to ensure that a document continues to hold weight over time (Frohmann, 2004). Such an adaption occurs, for example, when professionals use intranets to access organizational information that was once text based. Finally, the

weight or significance of a document is reflected in evidence of the materiality property it incorporates (Frohmann, 2004). In an example from science, the materiality of gravity is detected, although not seen, in a falling object. Evidence of materiality of oral information can be detected in the sound of voice (tone, register, and more), which can embody authority and other characteristics (Zumthor, 1990, see also Turner, 2009).

Frohmann's explanation of the properties of documents (2004) offers a way to identify how a document is shaped and influenced by practices that facilitate access to information. Frohmann (2004) refers to the properties as an analytical notion, explaining that they must be present because without them there would be no document. Turner (2009) study extends that explanation to consider if information that incorporates the properties of a document is, in fact, a document, even when that information is made available orally. Extending Frohmann's properties (2004) as criteria for identifying a document informs a way to empirically observe if an utterance can be a document.

As we explain before, one from some weaknesses of a social networking sites research tool is little or almost no testing has been carried out as of yet to evaluate the validity and reliability. Thus, oral documents help us better understand how individuals from various viewpoints and different stations in society encountered the full range of life in their day, from everyday routines to catastrophic events.

To sum up, there is no study about disaster-related information seeking behavior using oral documents. This research will use oral documents as a main research tool.

2.3 Information Transmission in Japan

Arai (2013) study about how to transmit disaster information effectively based on linguistic perspective on Japan's tsunami warnings and evacuation instruction. She examined a range of recordings of the tsunami warnings and the evacuation instructions given for the East Japan tsunami disaster from the perspective of linguistics, especially pragmatics, whose main objective is to discover how recipients interpret verbal messages. She proposed further improvement to the transmission system of tsunami warnings and evacuation instruction. Her study also emphasized the necessity and importance of reexamining the overall disaster information transmission issue in Japan, from the linguistics perspective.

Looking at disaster information transmission from the standpoint of addressees is very important. Arai (2011) suggested the importance of the addressees' viewpoint and applied the framework of pragmatics to disaster information transmission. Although an addresser tries to convey the necessity of evacuation by saying "Evacuation is necessary when the Evacuation Advice is issued," some addressees might think, "Until the Evacuation Advice is issued I can stay home." Kanai and Katada (2011) and Yamori (2009) pointed out that meta-message problems caused a delay in local residents' evacuation. A meta-message is usually inferred by the addressees, depending on their context.

In Japan to avoid information confusion, there are legally restricted information routes for Tsunami Warnings and the Evacuation Instructions. The hi-tech information transmission system and routes that are the pride of Japan are shown in Figure 2.2.

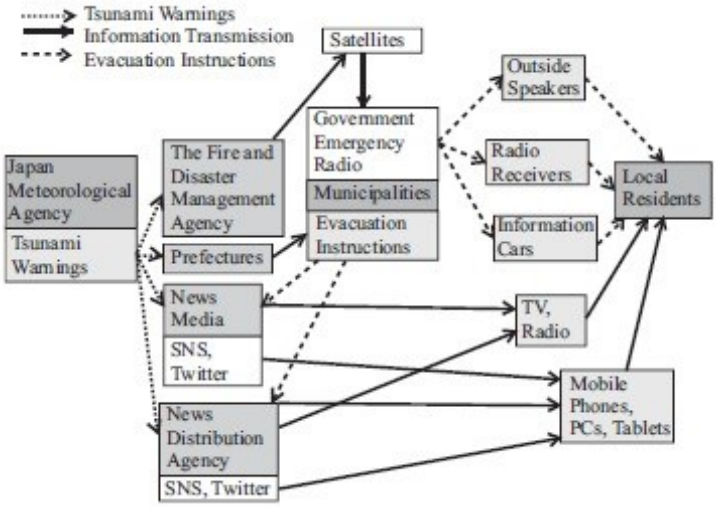


Figure 2.2 The Tsunami Warnings and the Evacuation Instruction (Arai, 2013)

When tsunamis are expected to occur, Tsunami Warnings are issued by the Japan Meteorological Agency (JMA), which is regulated by the Weather (Meteorological) Service Law. The Tsunami Warnings should be issued only by the JMA. This information is transmitted immediately to the municipalities through the Fire and Disaster Management Agency or the prefectures and also to the local residents who should also be alerted to the impending tsunami by the news media. By giving the authority to JMA the source can be limited and the credibility and reliability of the information can be maintained.

On the other hand, the Basic Act on Disaster Control Measures prescribes that only municipalities can issue the Evacuation Instructions (or Advice) through the agency of a city, town, or village. According to these laws, the JMA and each municipality can issue warnings and instructions, and other institutions and news media can only pass them on to the people (including local residents). Figure 2.2 shows how the Tsunami Warnings are transmitted to other institutions and how the Evacuation Instructions are transmitted to local residents.

In her conclusion, she found that the hi-tech information transmission system that is the pride of Japan was unable to send out the Tsunami Warnings effectively; many lives were lost as a result. Subsequently, the Japan Meteorological Agency (JMA) set up a committee of experts to improve the overall system. The changes are, however, problematic from the linguistics perspective as the committee did not include any experts in the field.

In conclusion, we will re-visit Arai's model (2013) about information flows and information transmission based on oral documents and describe our findings in discussion section.

Chapter 3
METHODOLOGY

In this chapter, we will describe our research procedures and the methods used in data analysis to construct our grounded theory process.

3.1 Research Context

This study focuses on the information-seeking behavior patterns which include information needs, sources channels and information seeking pathways during the warning and threat dislocation periods of the 2011 Great East Japan Earthquake and Tsunami. As we point out in literature review, one concept that we use for primary data collection is oral documents. We verified data by open coding to build up a grounded theory model of information-seeking behavior pattern in disaster.

As a start, deductive research begins with a pre-existing theory from which testable hypotheses are derived, but grounded theory begins with observations from which generalizations can be made (McKnight, 2007). Barney Glaser and Anselm Strauss first described grounded theory research as sociologists in the 1960s and explained its further development in several books (Glaser, 1978, 1992; Glaser and Strauss, 1999, Strauss, 1987; and Strauss and Corbin, 1998). We summarize the structure of current grounded theory research practice into stages of using Dey's theory (1999): (a) initiating research, (b) selecting data, (c) collecting data, (d) analyzing data, and (e) concluding research. Inherent to the grounded theory method is the practice of concurrent activities (b), (c) and especially (d). Research concludes (e) when the categories developed in (b), (c), and (d) become saturated and no new patterns emerge.

Documents provide a major form of data. Most qualitative research entails analyzing texts. Documents comprise one type of text whose form, content, purpose, accessibility, visibility, utility, legitimacy, and consequences, can raise intriguing questions. Grounded theories of documents can address form as well as content, audiences as well as authors, and production of the text as well as presentation of it. (Charmaz, 2014). We collect and analyze written texts of (i) publications of local government, power companies and news media organization to produce timeline datasets (ii) what people write and report about themselves during disaster after which we call it as behavior datasets. These documents enter research in multiple ways that reflect everyday life (Charmaz, 2014; Plummer, 2001). Such potential documents may be viewed as relevant for addressing our research questions. In the first step, we will present our documents collection and entire procedures in the matter of how to code our datasets.

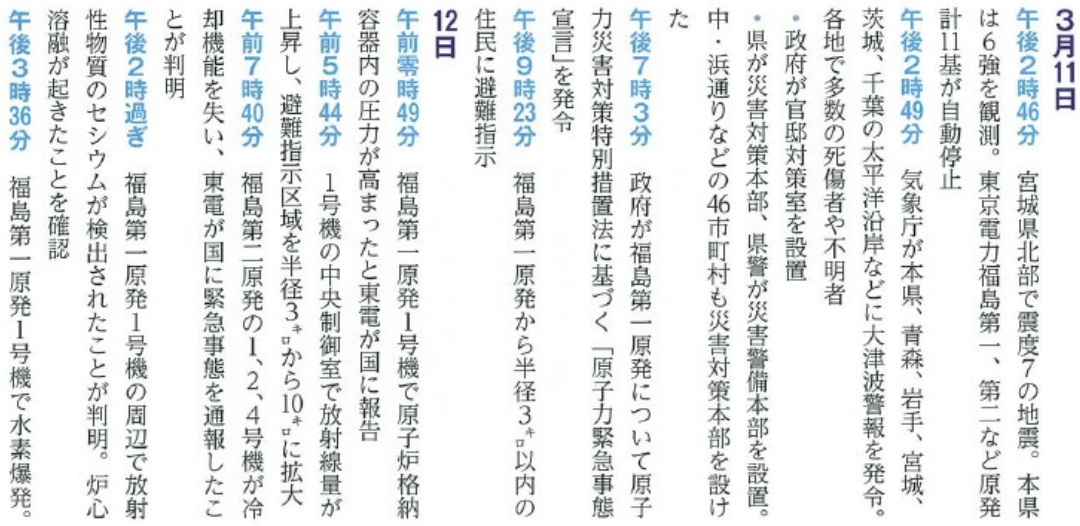
3.2 Collection of Documents

Our work began with gathering publications of local governments, power companies and news media (broadcasting) organization to arrange timeline and to portray temporal phases of disaster. We prospect six documents published after the 2011 Great East Japan Earthquake and Tsunami strikes. From six documents in Japanese, we divide into two category datasets; (i) timeline datasets and (ii) behavior datasets. Timeline datasets exist of three documents that consists of 353 annotations. Moreover, behavior datasets obtain of three documents that contains of 376 annotations. In the next section, we will demonstrate how we code timeline datasets and behavior datasets.

3.2.1 Timeline Datasets

An overall of three documents were considered for this study. The focus to arrange timeline datasets is to depict temporal phases of disaster. The following list presents a profile of the documents included in this study:

1. Article “2011.3.11 Higashinihon daishinsai no kiroku. Heisei 23 nen 11 tsuki. Kashima” (The Great East Japan Earthquake's Record. November 2011. Kashima) Page 4-6
2. Article “Daishinsai Dokyumento” (Earthquake Document) Page 67-71
3. NHK Book I “Higashinihon daishinsai shougen kiroku” (The Great East Japan Earthquake Diary)



3月11日
午後2時46分 宮城県北部で震度7の地震。本県は6強を観測。東京電力福島第一、第二など原発計11基が自動停止
午後2時49分 気象庁が本県、青森、岩手、宮城、茨城、千葉の太平洋沿岸などに大津波警報を発令。各地で多数の死傷者や不明者
・政府が官邸対策室を設置
・県が災害対策本部、県警が災害警備本部を設置。中・浜通りなどの46市町村も災害対策本部を設けた
午後7時3分 政府が福島第一原発について原子力災害対策特別措置法に基づく「原子力緊急事態宣言」を発令
午後9時23分 福島第一原発から半径3キロ以内の住民に避難指示
12日
午前零時49分 福島第一原発1号機で原子炉格納容器内の圧力が高まったと東電が国に報告
午前5時44分 1号機の中央制御室で放射線量が上昇し、避難指示区域を半径3キロから10キロに拡大
午前7時40分 福島第二原発の1、2、4号機が冷却機能を失い、東電が国に緊急事態を通報したことが判明
午後2時過ぎ 福島第一原発1号機の周辺で放射性物質のセシウムが検出されたことが判明。炉心溶融が起きたことを確認
午後3時36分 福島第一原発1号機で水素爆発。

Figure 3.1 Timeline datasets sample on article *Daishinsai Dokyumento* (Earthquake Document) Page 67-71

Figure 3.1 summarizes timeline datasets sample of some central information features about the post-disaster society, by depicting critical date and activities during the event. Thence, we compiled those datasets, we manually input it into

table using Microsoft Excel. We have gathered around 353 annotations from 11th March 2011 until 12th July 2011. Those annotations were diverse and some are from major affected areas. It shows that we have significantly broad data for timeline datasets.

We next show an example of timeline annotation on Figure 3.2 —a detailed timeline of the first day of the disaster that relates critical informational events. From eight column, we will describe each rows. "Sources" column describes the source name of the document. "Who" column is the actor –from government or organizational concern). "Start" and "End" shows the event date and time. On the "Duration Event" column, we can fill into two choices which is "True" and "False". We write "True" if the date mention the exact "End" time, for example, "Earthquake occurrence until Emergency Response Headquarters dissolution from 11th March 2011 until 11th July 2011". "Title", "Caption", and "Description" columns have the same narrative explanation of the event.

Source	Who	Start	End	Duration Event	Title	Caption	Description
Article 2011.3.11 *Higashinihon daishinsai no kiroku*. Heisei 23 nen 11 tsuki. Kashima (The Great East Japan Earthquake's record. November 2011. Kashima) Page 4-6	Kashima City Council	Mar 11 2011 00:00:00 GMT +0900	Jul 11 2011 00:00:00 GMT +0900	TRUE	Earthquake occurrence until Emergency Response Headquarters dissolution	Earthquake occurrence until Emergency Response Headquarters dissolution	Earthquake occurrence until Emergency Response Headquarters dissolution
Article 2011.3.11 *Higashinihon daishinsai no kiroku*. Heisei 23 nen 11 tsuki. Kashima (The Great East Japan Earthquake's record. November 2011. Kashima) Page 4-6	Japan Meteorological Agency	Mar 11 2011 14:46:00 GMT +0900	Mar 11 2011 14:46:00 GMT +090	FALSE	Magnitude 9.0 (8.4 before correction)	Magnitude 9.0 (8.4 before correction)	Magnitude 9.0 (8.4 before correction)
Article 2011.3.11 *Higashinihon daishinsai no kiroku*. Heisei 23 nen 11 tsuki. Kashima (The Great East Japan Earthquake's record. November 2011. Kashima) Page 4-6	Japan Meteorological Agency	Mar 11 2011 14:46:00 GMT +0900	Mar 11 2011 14:46:00 GMT +090	FALSE	Kurihara, Miyagi Prefecture: Seismic intensity 7	Kurihara, Miyagi Prefecture: Seismic intensity 7	Kurihara, Miyagi Prefecture: Seismic intensity 7
Article 2011.3.11 *Higashinihon daishinsai no kiroku*. Heisei 23 nen 11 tsuki. Kashima (The Great East Japan Earthquake's record. November 2011. Kashima) Page 4-6	Japan Meteorological Agency	Mar 11 2011 14:46:00 GMT +0900	Mar 11 2011 14:46:00 GMT +090	FALSE	Kashima : Seismic intensity lower than 6	Kashima : Seismic intensity lower than 6	Kashima : Seismic intensity lower than 6
Article 2011.3.11 *Higashinihon daishinsai no kiroku*. Heisei 23 nen 11 tsuki. Kashima (The Great East Japan Earthquake's record. November 2011. Kashima) Page 4-6	Japan Meteorological Agency	Mar 11 2011 14:46:00 GMT +0900	Mar 11 2011 14:46:00 GMT +090	FALSE	The Great East Japan Earthquake (Tohoku-Pacific Ocean Earthquake)	The Great East Japan Earthquake (Tohoku-Pacific Ocean Earthquake)	The Great East Japan Earthquake (Tohoku-Pacific Ocean Earthquake)

Figure 3.2 Example timeline annotation. Updates reflect new or updated information as it is reported.

This careful attention to temporal detail was fundamental to account for and interpret warnings, information flows and other activities. As a second stage of examination, we organized closer analyses of temporal description of disaster

events that help explain elements of information pathways we were seeing. Researchers often discuss the temporal descriptions of disaster events features as occurring in phases and being organized in spatial zones. Powell (1954) created a classification made up of eight temporal stages to illustrate the different social behaviors that take place across time (Figure 3.3). As Stoddard (1968) points out, time-and-space models are important methodological disaster research tools. The codification and classification efforts of these models are useful heuristic devices for organizing, describing, and explaining data, since the different disaster phases and zones represent different types of individual and group behavior (Stoddard, 1968; Neal, 1997). Palen and Liu (2007) also used these macro social descriptions of spatial and temporal ordering to help frame a larger set of imminent changes arising from pervasive information and communications technology diffusion.

Stage 0: PRE-DISASTER State of social system preceding point of impact
Stage 1: WARNING Precautionary activity includes consultation with members of own social network
Stage 2: THREAT Perception of change of conditions that prompts survival action
Stage 3: IMPACT Stage of "holding on" where recognition shifts from individual to community affect and involvement
Stage 4: INVENTORY Individual takes stock, and begins to move into a collective inventory of what happened
Stage 5: RESCUE Spontaneous, local, unorganized extrication and first aid; some preventive measures
Stage 6: REMEDY Organized and professional relief arrive; medical care, preventive and security measures present
Stage 7: RECOVERY Individual rehabilitation and readjustment; community restoration of property; organizational preventative measures against recurrence; community evaluation

Figure 3.3 Eight Socio-Temporal Stages of Disaster (Powell, 1954; Dynes, 1970)

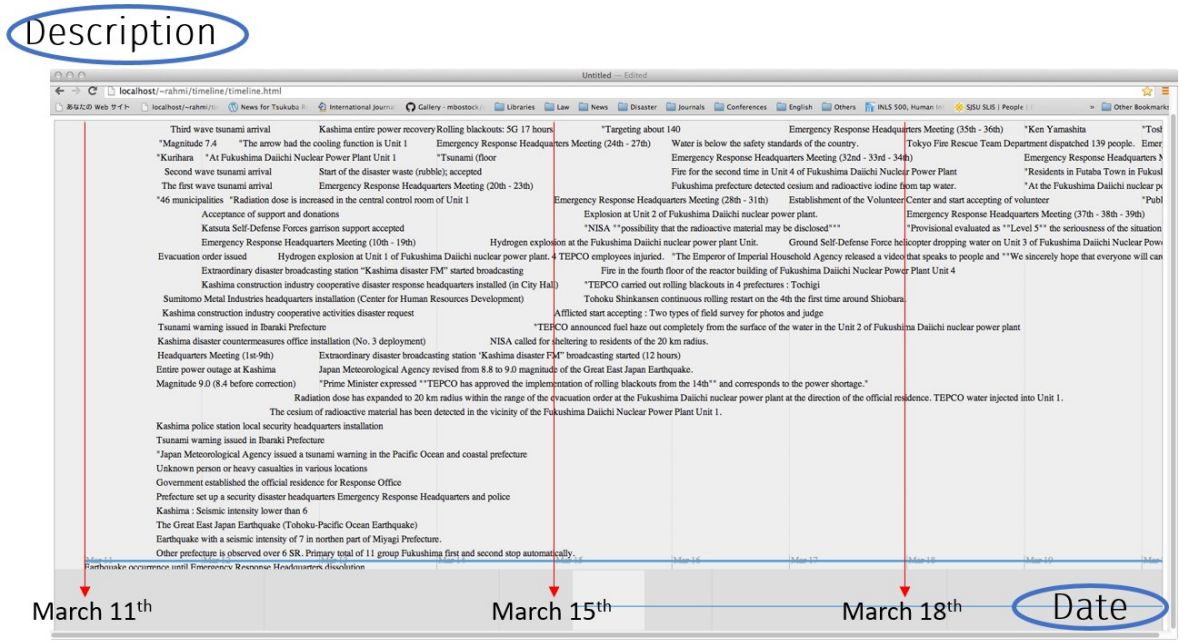


Figure 3.4 Timeline of selected post-disaster activities on SIMILE Widgets

After the codification on those table in Microsoft Excel, we presented timeline visualization using Timeline SIMILE Widgets (simile-widgets.org), which can be found in Figure 3.4. One function that this open-source web widgets offered is we can visualize temporal information on an interactive drag-able timeline. Then, we can break down our annotations into eight socio-temporal stages of disaster. This result will be given on the next chapter.

3.2.2 Behavior Datasets

For the second datasets –behavior datasets– a total of three reports were considered for this study. Behavior datasets focus is to grasp information seeking pathways, such as information needs, channels and sources. We gathered three oral documents (in Japanese) that consists of 143 people stories with 376 annotations during post-disaster event. The following list provides a profile of the documents included in the study:

1. Article “Kita Ibaraki Shinsaiki” (North Ibaraki’s Record)
2. Article “2011-nen 3-gatsu 11-nichi Iwaki : Tsutae tsugitai Higashinihon Daishinsai no Kiroku” (2011/3/11 – Iwaki City : The Great East Japan Earthquake Record)
3. Article “2011-3-11 Iwaki-shi, Higashinihon daishinsai no Shougen to Kiroku” (2011/3/11 – Iwaki City : Record of Testimony on The Great East Japan Earthquake)

We gathered diverse samples on very unique limited publication in a major affected areas such as Iwaki City, Fukushima Prefecture and North Ibaraki, Ibaraki Prefecture. Both location shown on Figure 3.5.

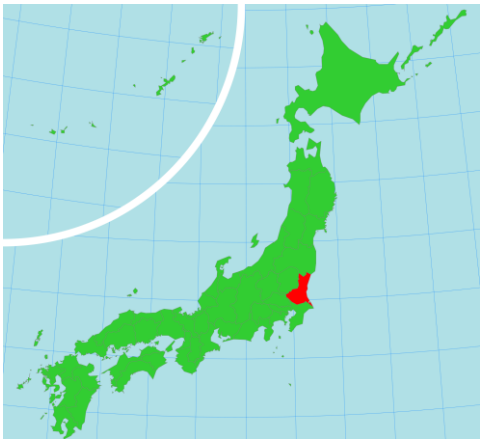


Figure 3.5 Location of North Ibaraki, Ibaraki Prefecture & Iwaki City, Fukushima Prefecture

First, we manage our behavior datasets that consists of the activities to organize information so it can be analyzed. It starts with the analysis plan and ends when the data analysis itself begins. Data management activities include (i) drafting analysis plan, (ii) creating codebook, (iii) establishing reliable coding, (iv) reviewing surveys for incomplete or missing data, (v), entering data and validating the accuracy of the entry, and (vi) cleaning the data (Fink, 2003).

Before we create a codebook, we define a code. Codes usually are the unit or symbols that computer programs use to identify variables. However, we manually input each codes from author judgement. Suppose from oral documents, we want to know information needs from people stories. One question of concern to us is what information needs people report on disaster situation in oral documents. To find out what we want to know on this topic, we make classification to make a reliability checklist which variables to look for (in this case, for example, needs about tsunami warning, disaster information or evacuation instruction). Our codebooks contain descriptions of the questions, codes, and variables associated with the oral documents for which the codebook were created.

At the beginning, we analyze one oral document with just one person (the author) doing the coding and can assure the reliability of the data by recording all or a sample of the data to check for consistency. Then, we do the second coding for the coder to forget the first set of coders so that we do not just automatically reproduce them. After the data are coded a second time, we compare the two sets of codes for agreement.

Thus, the author's mother tongue is not Japanese and because of behavior datasets become larger and recruit person stories, we resolve disagreements by calling in two persons to arbitrate. In large sample of behavior datasets, we have two persons independently code a sample of the data. To assure reliability between coders, you need to provide the coders with formal training as well as clear definitions of all term. They were asked to circles the information regarding needs, sources, and channels. After that, the main coder (the author) do translate, check for reliability and consistency, and make a judgement about each annotations.

Because of a large number of potential annotations, we asked two persons independently to code information seeking descriptions with the three oral documents. To assure reliability between coders, we provided the coders with instructions. They should have several criteria such as (i) a native Japanese speaker,

(ii) a student who is enrolled in Schools of Library, Information and Media Studies, University of Tsukuba and (iii) they understand basic concept of information-seeking behavior. Both of them were chosen to code a sample of the data from three oral documents. To assure reliability between coders, we need to provide the coders with formal training as well as clear definitions of all terms.

Despite our best efforts at setting up a high-quality codebook and data management system, the coders may not always agree with another. To find out about the extent of their agreement –intercoder or interrater reliability– we calculate a statistic called Cohen's kappa coefficient (κ), which measures how much better than chance the agreement between a pair of coders.

Two reviewers were asked to review independently 143 people's experience described in oral documents and encountered about 376 annotations (Figure 3.6). Thus, the reviewers were to study the transcripts to find out how each person mentioned about code categories such as information needs, sources and channels during the disaster.

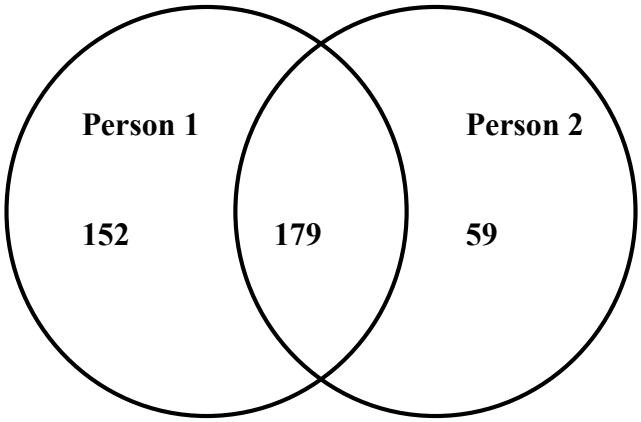
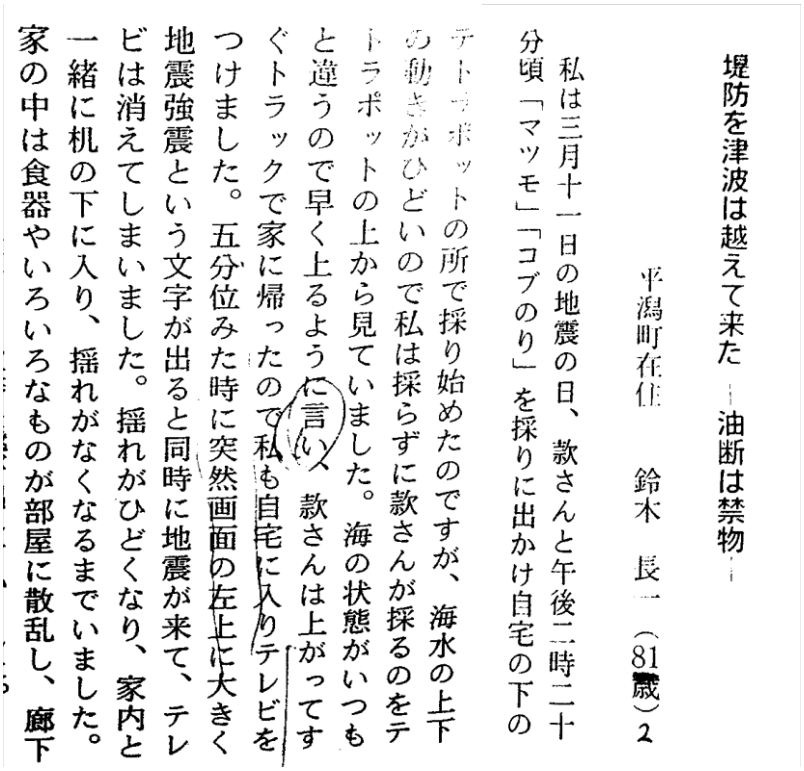


Figure 3.6 Kappa's calculation on 376 annotations

Some experts have attached the following qualitative terms to kappa: 0.0-0.2 = slight; 0.2-0.4 = fair; 0.4-0.6 = moderate; 0.6-0.8 = substantial, and 0.8-0.10

= almost perfect (Carletta, 1996). We obtained the "fair" kappa (0.47). The result can be due to differences between the reviewers' definitions, poor training in the use of the definitions and mistakes in coding.



堤防を津波は越えて来た ―油断は禁物―

平潟町在住　鈴木　長一（81歳）2

私は三月十一日の地震の日、款さんと午後二時二十分頃「マツモ」「コブのり」を採りに出かけ自宅の下のテトラポットの所で採り始めたのですが、海水の上下の動きがひどいので私は採らずに款さんが採るのをテトラポットの上から見ていました。海の状態がいつもと違うので早く上るように言い、款さんは上がってすぐトラックで家に帰ったので私も自宅に入りテレビをつけました。五分位みた時に突然画面の左上に大きく地震強震という文字が出ると同時に地震が来て、テレビは消えてしまいました。揺れがひどくなり、家内と一緒に机の下に入り、揺れがなくなるまでいました。家の中は食器やいろいろなものが部屋に散乱し、廊下

Figure 3.7 Behavior datasets sample on North Ibaraki Disaster Diary Page 12-13

On the first step, we establish a reliable coding, for example Figure 3.7 as a behavior datasets. It displays Mr. Suzuki's story (81 years old) during the event. From this, we extract several information:

(i) "Strange status of sea condition that he got from friends." This information considered as input or passive information needs. We categorize it to passive information needs and information source.

(ii) "As soon as he came back home, he turn-on his television and got information about earthquake warnings. About 5 minutes after earthquake warning, the big earthquake strikes and television automatically turn-off." We select this information as passive

information needs that Mr. Suzuki got from television (considered as information channel).

As the behavior datasets generated during a disaster are extremely varied, we need to start by filtering out each code into categories that do contribute to valuable information. We define each person stories into several code categories such as information needs (include passive and active), information channels, and information source. Specifically, we start by separating code into three main categories:

1. **Information Needs**: if a message coveys/report a recognition that people's knowledge is inadequate to satisfy a goal that they have. Also, we divide into two categories, passive information needs and active information needs.

    a. **Passive Information Needs**: is the behavior which receiving or subjected to an action without responding or initiating an action in return. Several kind of information that people search passively during the disaster are below.

        - "Disaster Information" category includes disaster information, damage and loss information, disaster preparedness information, earthquake information, and tsunami information;
        - "Warning" category includes earthquake early warning (EEW) and tsunami warning;
        - "Electricity Information";
        - "Evacuation Instruction" category includes evacuation instruction, finding shelter;
        - "Hospital condition" category includes hospital condition, patient safety, dispatch information for health workers, health care exam place;

- "Current status" category includes regional damage condition, Tohoku condition, Iwaki city; and,
- Nuclear accident.

b. Active Information Needs: is the act of actively seeking information in order to answer a specific query. Several kind of information that people search actively during the disaster are below.

- "Disaster Information" category includes damage and loss information, disaster preparedness information, earthquake information
- "Warning" category includes earthquake early warning, tsunami warning
- "Evacuation Instruction" category includes evacuation instruction, finding shelter
- "Post-tsunami Supplies and Equipment" category includes water outage and saving water, gasoline and diesel supply, support material and water, food, clothes distribution
- "Education" category includes school postponement, entrance exam result
- "Status" category includes Family status, fishing vessel
- "Transportation" category includes road closure and public transportation information, train condition

2. Information Channels: if a message reports about how people keep in touch with information. The summaries are below.

- "Speakers" category includes ambulance and fire brigade truck's sounds alarm warning, city's public relation car, helicopter, office speakers, police car, resident speaker, school's broadcasting

- “Face to Face” category includes people shouting, student's shouting, teacher's instruction
- “Phone” category includes mobile phone, public telephone
- “Mail” category includes email/text message (phone), news (phone)
- “Radio” category includes radio, cell phone radio, car radio, wireless radio, radio station
- “Television” category includes inside (television, news, Kobe television, NHK television), Outside (in-car television)
- “Internet” category includes government or agency website, SNS
- “Others” category includes movie screen, helicopter

3. **Information Sources:** if a message points to information sources that providing extensive coverage.

    - “Local Government” category includes city hall staff, district officer, Fukushima prefecture, government, ministry, prefecture leader, company’s resident, public relations, staff member, support center
    - “Foreign Government: category includes Australian government
    - “Education” category includes parent/guardian, kindergarten president, head of parent-teacher association, school student, teacher
    - “Health and Safety” category includes ambulance, fire brigade, local fire volunteer department, nuclear safety commission, person from health center, police
    - “Transportation” category includes train company
    - “Family/Neighborhood” category includes family, friend, neighborhood, someone

Once a code has been classified into one of the above category, code category-relevant information can be extracted for further analysis. For example, we want to know the correlation between information needs and information channels can be identified in the result chapter. Figure 3.8 shows an example of behavior annotation —a detailed information about information needs (passive and active) through what channels and what sources that depicts critical informational disaster events.

From 143 people in oral documents, we extract about 376 annotations of behavior datasets. Hence, we can visualize interrelationship between each code categories with d3.js (https://github.com/mbostock/d3/wiki/Gallery). We will present our visualization in the next chapter.

NO	BOOK	AGE	NAME	OCCUPATION	GENDER	PASSIVE INFORMATION				ACTIVE INFORMATION				DESCRIPTION	STAGE	P1	P2
						NEEDS	CHANNELS	SOURCES	WHEN	NEEDS	CHANNELS	SOURCES	WHEN				
	震災記北茨城																
1	p. 12	57	武子 尚之	平潟漁業協同組合 Business Manager	F	Tsunami Warning	Sirens									Yes	Yes
						Finding Shelter		Staff Member						Near coast area at Hiragata and No sirens & public alarm.		Yes	Yes
2	p.13	81	鈴木 長	City resident	M					Sea condition is strange						Yes	Yes
						Earthquake Early Warning	Television							At the same time of information, the electricity was cut off		Yes	Yes
						Tsunami Warning		Someone								Yes	
						Evacuation Instruction		Neighborhood								Yes	
						House Condition		Someone						Someone's home washed away		Yes	Yes

Figure 3.8 Example of Behavior Annotation

Chapter 4
RESULT

This chapter we will present our findings of timeline datasets and behavior datasets. First, we will report timeline datasets findings such as temporal model and information flows. Thus, we will address behavior datasets findings.

4.1 Timeline Datasets Findings

4.1.1 Temporal Model

Each data entry has its post time, an actor and an event description. When a target event occurs, we describe the temporal and spatial of disaster events. We use eight temporal stages by Powell (1954) to illustrate the different social behaviors that take place across. Due to time constraint, we provide findings from two important stage, warning and threat.

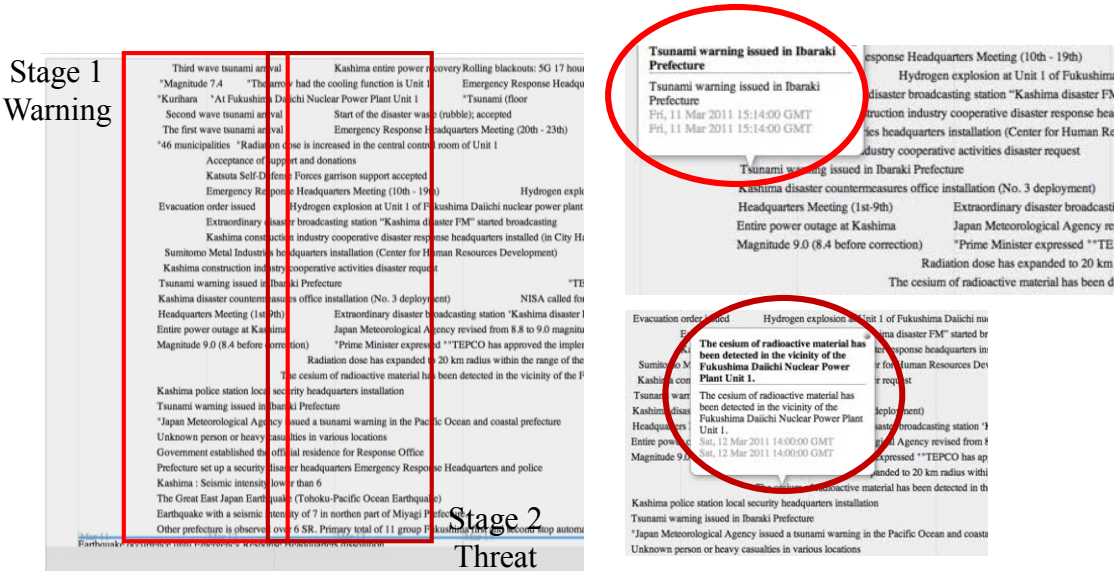


Figure 4.1 Two Temporal Stages, Warning and Threat

From the total of 353 annotations, we found 37 annotations associate with warning stage and 71 annotations refer to threat stage. It should be noted that we categorize warning stage as precautionary activity. Most of warning happened on the first day of the event with a total 34 annotations on March and 3 annotations on April. Warning stage includes earthquake, tsunami and aftershocks information. Some examples for warning stage:

> "Japan Meteorological Agency issued Earthquake Warning on March 11th 2011 at 14:46 JST"

> "On April 11th Kashima City Council issued earthquake warning at 17:16 JST"

Another point to state is that threat represents the second stage, focusing upon actions related to surviving an impact. A total of 71 annotations with details of 53 annotations on March, 9 annotations on April, 8 annotations on May and 1 annotation on June. Threat occurs when there is side effects from earthquake and tsunami such as the following entry.

> "Prime Minister issued a declaration of a nuclear emergency situation of the first nuclear power plant on the same day as earthquake and tsunami happened, March 11th 2011 at 19:03 JST"

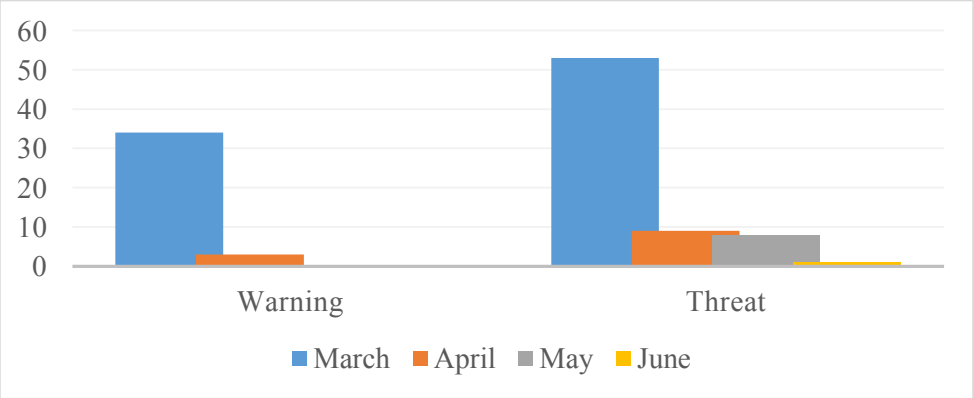


Figure 4.2 Number of annotations related to the phases of disaster

It shows boundaries across phases are always fuzzy and stage-related behavior can be concurrent. In this research, we have found that the activities occurring at warning and threat stages in the 2011 Great East Japan Earthquake and Tsunami include significant investment in information gathering, generating, and sharing through peer-to-peer and official communications (especially by government, institution or people who were remotely located away from the event). Motivated by this finding, we want to provide some kind of assistance, for example earthquake and tsunami warning. We will present it to the next sub-section about information flows.

4.1.2 Information Flows

To avoid information confusion, Japanese government is legally restricted information routes for Tsunami Warnings and the Evacuation Instructions. From timeline datasets, the information transmission routes are shown in Figure 4.3.

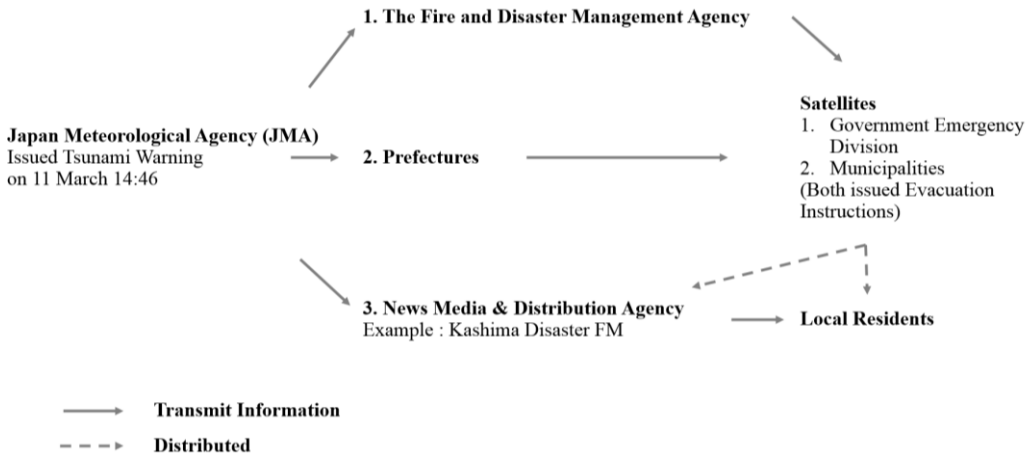


Figure 4.3 Information Flows Tsunami Warnings and the Evacuation Instruction

When tsunamis are expected to occur, Tsunami Warnings are issued by the Japan Meteorological Agency (JMA), which is regulated by the Weather (Meteorological) Service Law (Arai, 2013). The Tsunami Warnings should be

issued only by the JMA. First, this information is transmitted immediately to the municipalities through the Fire and Disaster Management Agency, for example: Fire Brigade, Ground Self-Defense Force and Kashima Police Station. Second, the prefectures such as Fukushima Prefecture, Ibaraki Prefectural Governor, Kashima City council and also to the local residents who should also be alerted to the impending tsunami by the news media e.g. Kashima Disaster FM. By giving the authority to JMA the source can be limited and the credibility and reliability of the information can be maintained (Arai, 2013).

This information flows also confirmed the Basic Act on Disaster Control Measures (1961) prescribes that only municipalities can issue the Evacuation Instructions (or Advice) through the agency of a city, town, or village. According to these laws, the JMA and each municipality can issue warnings and instructions, and other institutions and news media can only pass them on to the people (including local residents). Figure 4.3 also shows how the Tsunami Warnings are transmitted to other institutions and how the Evacuation Instructions are transmitted to local residents.

4.2 Behavior Datasets Findings

This section will report on a different dataset –behavior dataset– of findings that describe some features of the information-seeking behavior such as information needs (passive and active), information channels and information sources.

4.2.1 Basic Demographic Characteristics

Although the size of the data samples prevent any analysis of gender, age or occupation and possible links to information source preferences, this basic demographic characteristics given in the oral documents and in order to lay the groundwork for further research.

The following table presents information on the people appeared in our oral documents whose had been involved at the time of the disaster in Japan. From the total of 143 people in oral documents, a total of 92 male, 50 female, and 1 did not mentioned in oral documents.

Female	50
Male	92
Not Available	1

Table 4.1 Gender distribution on the oral documents' transcript

Another thing to mention is the age distribution. A total of 143 people in oral documents, we found that 2 people is below 25 years old; 11 people is between 25-39 years old; 19 people is between 40-55 years old; 35 people is between 56-70 years old; 4 people is above 71 years old; and 71 persons did not revealed their ages in oral documents.

< 25	2
25 - 39	11
40 - 55	19
56 - 70	35
71 +	4
Not Available	71

Table 4.2 Age distribution on the oral documents' transcript

As can be seen from table 4.1 and table 4.2, we found that the most mentioned gender in oral documents that we use was male. Moreover, the most revealed age in oral documents was 56 until 70 years old. Though most of the people in oral documents were located in the affected areas, it did not represent the whole

nation of Japan. Also, it means the population or victim in some major disaster areas might be the elderly that work actively in several occupation or employment sectors.

4.2.2 Channels vs. Passive Needs and Active Needs

In this sub-section, we present the connection visualization between information channels and passive information needs as well as information channels and active information needs. With this view, we will know which channels that people mostly used during disaster with or without responding or initiating an action in return (actively or passively).

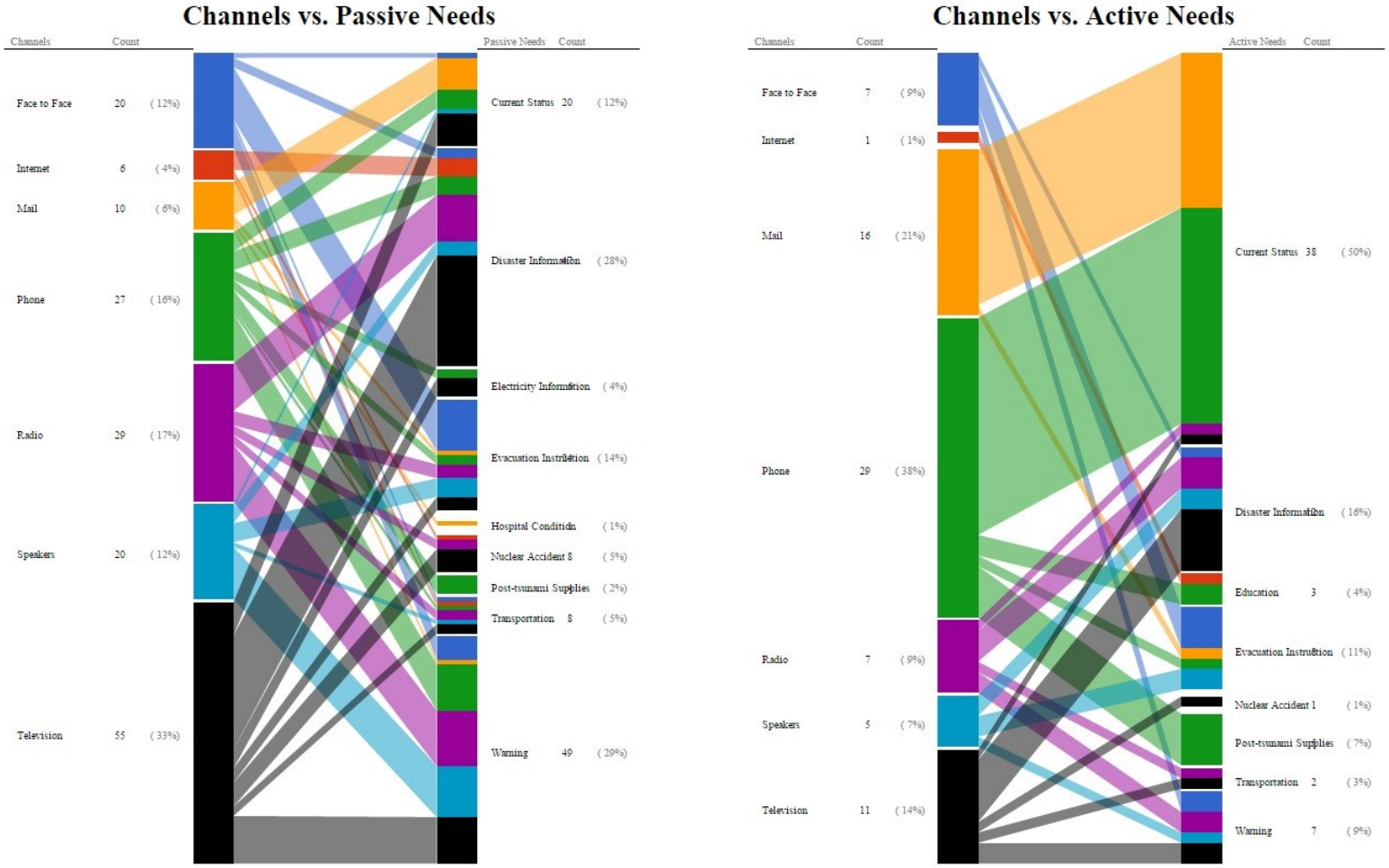


Figure 4.4 Channels vs. Passive Needs and Active Needs

In **passive information needs**, the most used channel during the disaster was mainly television (n= 55). From here, people then considered other channels such as radio (n= 29), phone (n= 27), face to face (n= 20), speakers (n= 20), mail (n= 10) and internet (n= 6).

Television is used mostly to disseminate disaster information (n= 24), warning (n= 10), current status (n= 7), nuclear accident (n= 5), electricity information (n= 4), evacuation instruction (n= 3), and transportation (n= 2). The following table presented what kind of passive information needs that most people want to know through different channels.

Passive Needs type	**Channels type**
Disaster Information (n= 47)	Television (24), Radio (10), Internet (4), Phone (4), Speakers (3) and Face to Face (2)
Warning (n= 55)	Radio (12), Speakers (11), Television (10), Phone (10), Face to Face (5) and Mail (1)
Electricity Information (n= 6)	Television (4) and Phone (2)
Evacuation Instruction (n= 24)	Face to Face (11), Speakers (4), Radio (3), Television (3), Phone (2) and Mail (1)
Education (n= 0)	
Hospital Condition (n= 1)	Mail (1)
Current Status (n= 20)	Mail (7), Television (7), Phone (4), Speakers (1) and Face to Face (1)
Transportation (n= 8)	Radio (2), Television (2), Speakers (1), Face to Face (1), Phone (1) and Internet (1)
Post-tsunami Supplies (n= 4)	Phone (4)

Nuclear Accident (n= 8)	Television (5), Radio (2) and Internet (1)

Table 4.3 Passive information needs and channels type

In **active information needs**, the most used channel during the disaster was mainly phone (n= 29), followed by mail (n= 16), television (n= 11), face to face (n= 7), radio (n= 7), speakers (n= 5) and internet (n= 1).

Phone is used mostly for people to seek information actively in order to answer a specific query, for example contacting family or relatives (n= 21). Other active information needs that using phone was post-tsunami supplies (n= 5), education (n= 2), and evacuation instruction (n= 1). The following table presented what kind of active information needs that most people seek actively through different channels.

Active Needs type	**Channels type**
Disaster Information (12)	Television (6), Radio (3), Speakers (2) and Face to Face (1)
Warning (n= 7)	Face to Face (2), Radio (2), Television (2) and Speakers (1)
Electricity Information (n= 0)	
Evacuation Instruction (n= 8)	Face to Face (4), Speakers (2), Phone (1) and Mail (1)
Education (n= 3)	Phone (2) and Internet (1)
Hospital Condition (n= 0)	
Current Status (n= 38)	Phone (21), Mail (15), Radio (1) and Television (1)
Transportation (n= 2)	Radio (1) and Television (1)
Post-tsunami Supplies (n= 5)	Phone (5)

Nuclear Accident (n= 1)	Television (1)

Table 4.4 Active information needs and channels type

To sum up, our findings show the different channels of passive needs and active needs. In passive information needs, the most used channel during the disaster was mainly television. While in active information needs, phone is used mostly for people to seek information actively in order to answer a specific query, for example contacting family or relatives.

4.2.3 Sources vs. Passive Needs and Active Needs

In **passive information needs**, the most used sources during the disaster was mainly from family/neighborhood (n= 69). From here, people then looked for information across a range of sources, local government (n= 29), health and safety (n= 27), education (n= 5), transportation (n= 2) and foreign government (n= 1).

Most people in oral document get information from their family/neighborhood about evacuation instruction (n= 25), warning (n= 17), current status (n= 12), disaster Information (n= 10), electricity information (n= 3), post-tsunami supplies (n= 2). This following table showed what kind of passive information needs that most people want to know through different sources.

Passive Needs type	**Sources type**
Disaster Information (n= 19)	Family/Neighborhood (10), Local Government (5), Education (1) and Health and Safety (3)
Warning (n= 29)	Family/Neighborhood (17), Health and Safety (8), Local Government (2), Education (1) and Transportation (1)

Electricity Information (n= 6)	Family/Neighborhood (3) and Health and Safety (3)
Evacuation Instruction (n= 45)	Family/Neighborhood (25), Local Government (10), Health and Safety (7), Foreign Government (1), Education (1) and Transportation (1)
Education (n= 0)	
Hospital Condition (n= 3)	Local Government (2) and Health and Safety (1)
Current Status (n= 17)	Family/Neighborhood (12), Local Government (3) and Health and Safety (2)
Transportation (n= 5)	Health and Safety (3) and Education (2)
Post-tsunami Supplies (n= 6)	Local Government (4) and Family/Neighborhood (2)
Nuclear Accident (n= 3)	Local Government (3)

Table 4.5 Passive information needs and sources type

In **active information needs**, the most used sources during the disaster was mainly from family/neighborhood (n= 34), followed by education (n= 8), local government (n= 8) and health and safety (n= 7).

Most people in oral document seek information actively from their family/neighborhood about evacuation instruction (n= 8), warning (n= 3), current status (n= 19), disaster Information (n= 2), electricity information (n= 3), post-tsunami supplies (n= 2). This following table showed what kind of passive information needs that most people want to know through different sources.

Passive Needs type	**Sources type**
Disaster Information (n= 6)	Family/Neighborhood (2), Education (2), Health and Safety (1) and Local Government (1)
Warning (n= 6)	Family/Neighborhood (3), Health and Safety (2) and Education (1)
Electricity Information (n= 6)	Health and Safety (3) and Family/Neighborhood (3),
Evacuation Instruction (n= 17)	Family/Neighborhood (8), Local Government (3), Education (3) and Health and Safety (3)
Education (n= 2)	Education (2)
Hospital Condition (n= 3)	Local Government (2), Health and Safety (1)
Current Status (n= 21)	Family/Neighborhood (19) and Local Government (2)
Transportation (n= 0)	
Post-tsunami Supplies (n= 4)	Local Government (2) and Family/Neighborhood (2)
Nuclear Accident (n= 0)	

Table 4.6 Active information needs and sources type

In conclusion, our findings show the same sources, family/neighborhood, that people use to fulfill their passive information needs and active information needs.

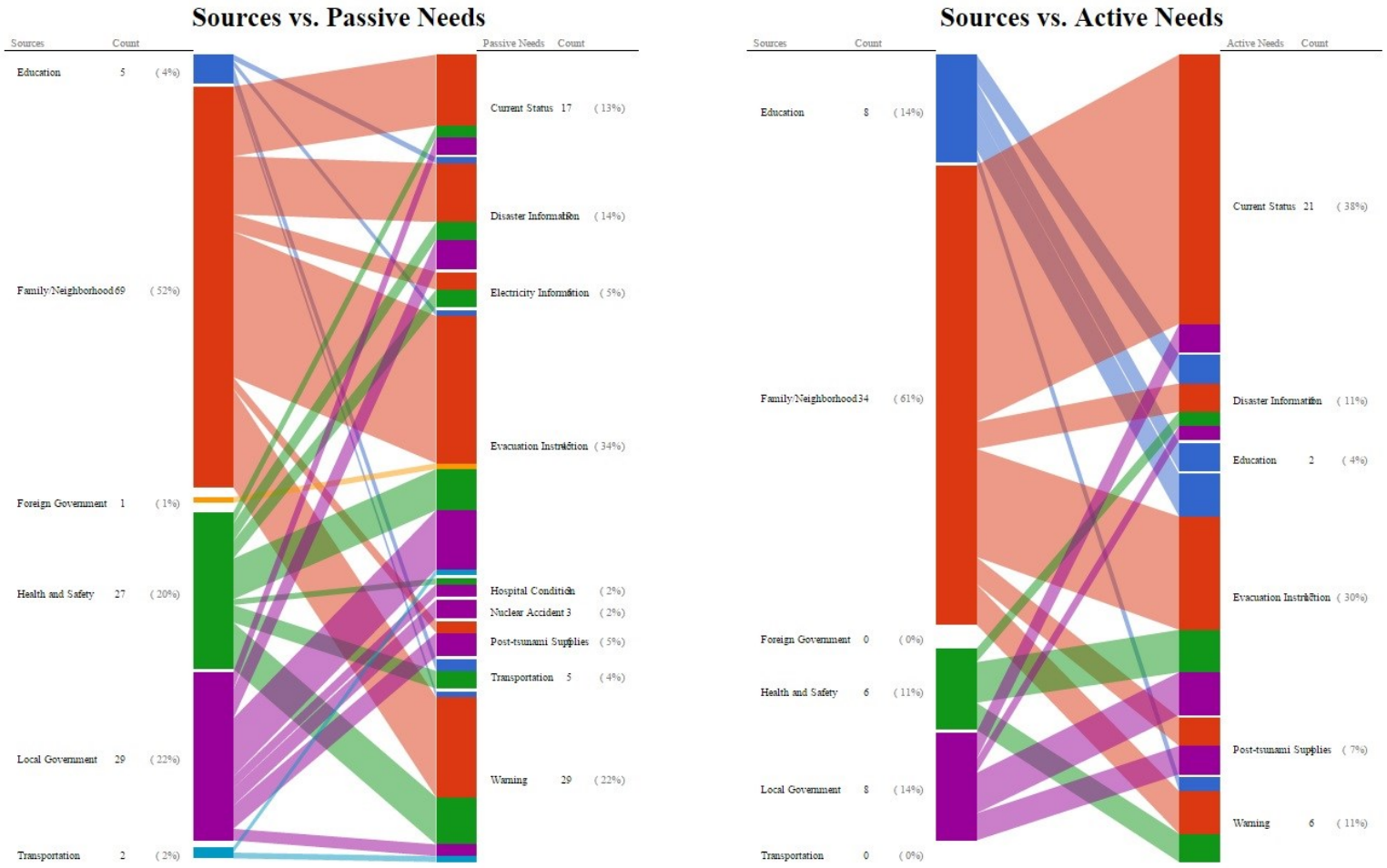


Figure 4.5 Sources vs. Passive Needs and Active Needs

4.2.4 Passive/Active Channels vs. Sources

In this visualization, some annotations mentioned both channels and sources in the same activity. From this findings, we found or provide two definitions that channels used in passive information needs called passive channels and sources that used in passive information needs called passive sources.

In **passive information needs**, most used channel is face to face (n= 16), followed by mail (n= 7), phone (n= 6), speakers (n= 3), radio (n= 1) and television (n= 1). The sources mostly they got form family/neighborhood (n= 19), health and safety (n= 5), local government (n= 5), education (n= 4) and transportation (n= 1)

The following table showed through what sources and channels people got the information –passively searching and actively searching–

Passive Channels type	**Passive Sources type**
Speakers (n= 3)	Education (2) and Health and Safety (1)
Face to Face (n= 16)	Family/Neighborhood (12), Education (2), Health and Safety (1) and Transportation (1),
Phone (n= 6)	Health and Safety (3), Local Government (2) and Family/Neighborhood (1)
Mail (n= 7)	Family/Neighborhood (4) and Local Government (3)
Radio (n= 1)	Family/Neighborhood (1)
Television (n= 1)	Family/Neighborhood (1)

Table 4.7 Information channels and sources on Passive Needs

In **active information needs**, most used channel is phone (n= 13), followed by mail (n= 7), face to face (n= 4), and speakers (n= 2). Most people used sources from family/neighborhood (n= 16), education (n= 5) and local government (n= 5).

The following table showed through what sources and channels people got the information –passively searching and actively searching–

Active Channels type	**Active Sources type**
Speakers (n= 2)	Education (2)
Face to Face (n= 4)	Family/Neighborhood (2), Local Government (1) and Education (1),
Phone (n= 13)	Family/Neighborhood (8), Local Government (3) and Education (2),
Mail (n= 7)	Family/Neighborhood (6) and Local Government (1)

Table 4.8 Information channels and sources on Active Needs

As we can summarize from our findings, in passive information needs, most used channel is face to face and most used sources is family/neighborhood. While in active information needs, most used channel is phone and most used sources is family/neighborhood.

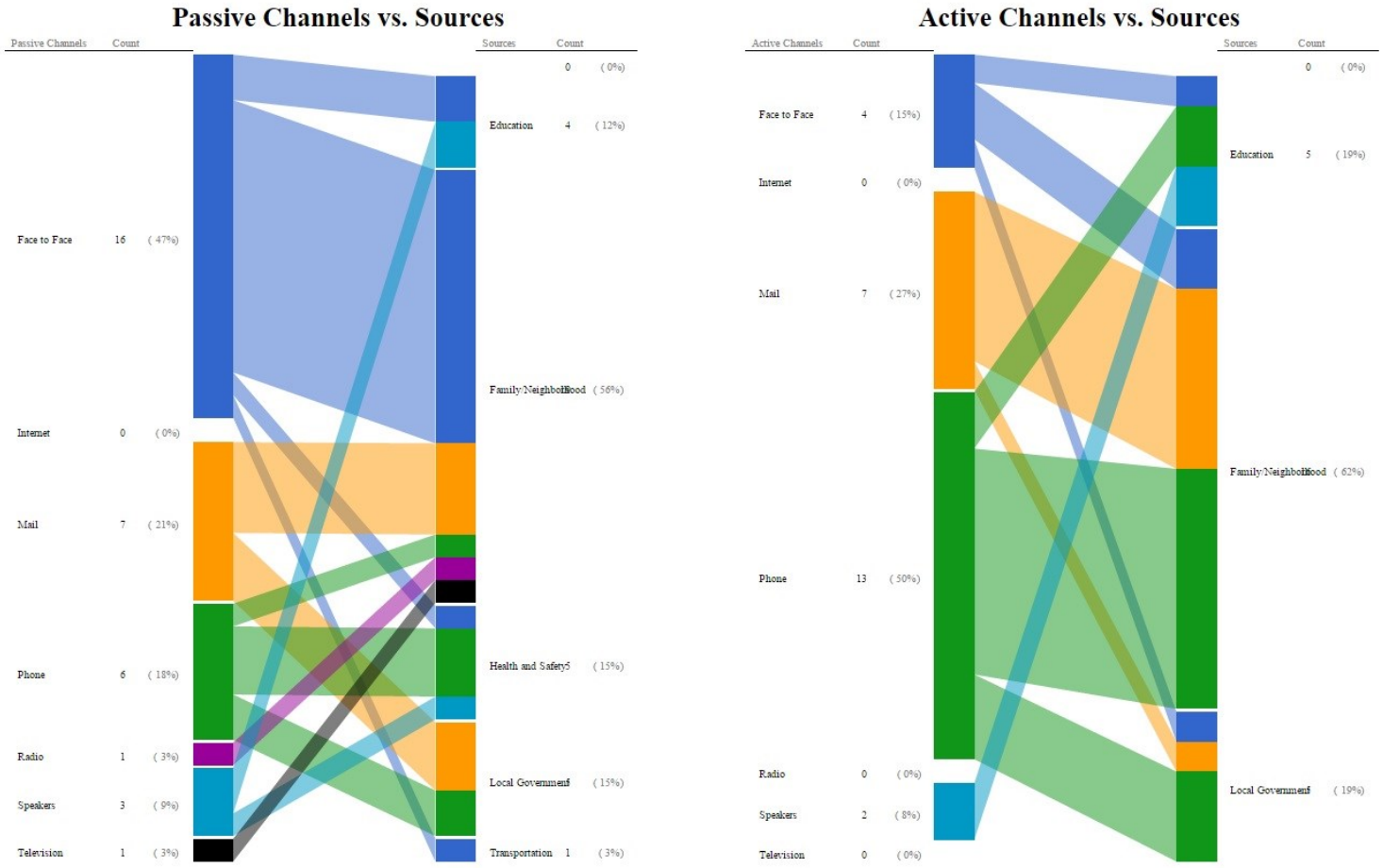


Figure 4.6 Passive/Active Channels vs. Sources

Chapter 5
DISCUSSION

In this section, we will focus on three main findings of our analyses. First, we discuss temporal descriptions to transmit disaster information. Second, we argue about the comparison with the framework of everyday life information seeking model. Finally, we describe about our limitations.

5.1 Temporal Descriptions to Transmit Disaster Information

When the disastrous tsunamis hit East Japan on March 11th 2011, the hi-tech information transmission system that is the pride of Japan was unable to send out the Tsunami Warnings effectively; many lives were lost as a result (Arai, 2013). On the other hand, researchers use the dimensions of time and space to explain how events develop and how to operate in the networked world using social networking sites (Liu et. al., 2009). However, there is no explanation about how researchers develop those dimensions using oral documents.

First, disaster researchers and practitioners often use spatial and temporal models (Dynes, 1970; Powell, 1954) to describe and anticipate macro social behavior. Powell (1954) created a classification made up of eight temporal stages to illustrate the different social behaviors that take place across time. As Stoddard (1968) points out, time-and-space models are important methodological disaster research tools. The codification and classification efforts of these models are useful heuristic devices for organizing, describing, and explaining data, since the different disaster phases and zones represent different types of individual and group behavior (Stoddard, 1968; Neal, 1997). Palen and Liu (2007) used these macro social descriptions of spatial and temporal ordering to help frame a larger set of imminent

changes arising from pervasive information and communications technology diffusion. In this study, we use two stages of disaster phase, warning and threat.

Second, in our findings we found around 37 annotations on the warning stage and 71 annotation on the threat stage from the total of 353 annotations. It means that after the small number of precautionary activities, people more focus upon actions related to surviving an impact. We also found some boundaries and ambiguity using eight different disaster-time stages to apply in our timeline datasets. It is always fuzzy and stage-related behavior can be concurrent. Dynes (1970) and Powell (1954) model are meant to serve as helpful categorizations to support planning and explain social behavior after the fact; they are not accurate definitions of what can or should be happening when a disaster unfolds. As such, we need to more deeply attach such conceptualizations of large-scale crises to matters of process.

Our analysis of mapping timeline events to temporal stages can provide some tangible data to better define the stages. Using a grounded theory approach, we found that timeline datasets that we extract from oral documents aided us to analyze people information transmission in their ability to recover from ongoing disruption in accordance with two stages of Powell's model (1954), warning and threat. For example, Japan Meteorological Agency (JMA) issued Earthquake Warning on 11th March 2011 at 14:46 JST. This shows that information transmission about warning was useful to remove disruption within community.

As we present our findings in the chapter four, we found that tsunami warnings are issued by the Japan Meteorological Agency when earthquake and tsunamis are expected to occur. Although there are relevant legal requirements in Japan, in reality the functional information system did not seem to work out in an ideal way. For example, earthquake warning in some channels. One problem that may occur is due to the multiple sources and channels of warning information. Local residents receive information from a number of different media, so they could

easily get confused by the earthquake and tsunami warnings, and the Evacuation Instructions. This problem happened because the electricity supply was cut after the great earthquake. When the electricity supply is cut, the resulting situation is as simulated in Figure 5.1. There were many people who could not see the images of the tsunamis impacting many of East Japan's coastal areas, which were broadcast all over the world, until a few weeks later when the electricity supply was restored. The terrible images might have persuaded many people to evacuate the disaster area before they did.

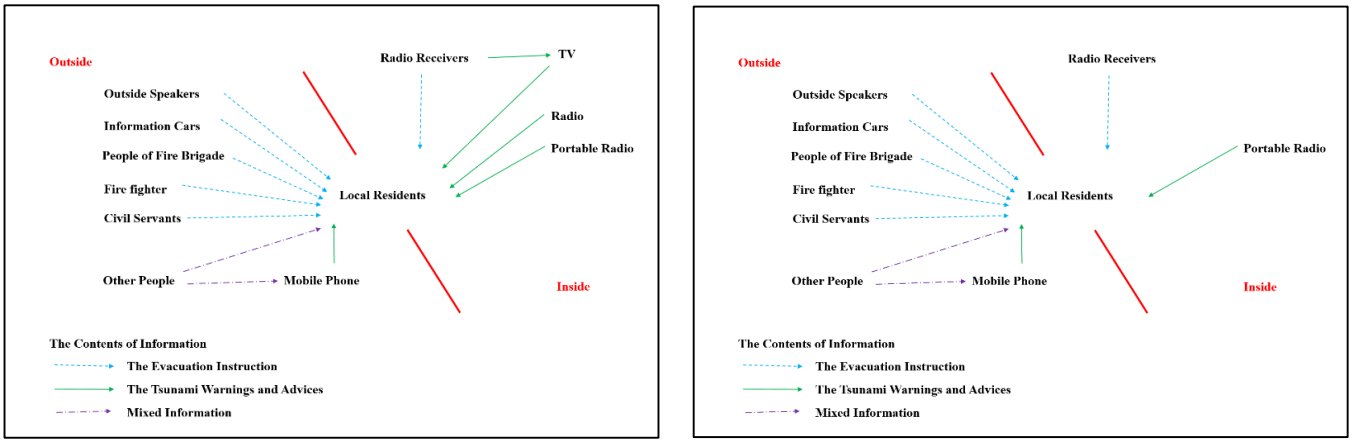


Figure 5.1 Information dissemination with electricity and without electricity

This model confirm Arai's study on how to transmit disaster information effectively based on linguistic perspective on Japan's tsunami warnings and evacuation (Figure 5.2). However, in our findings, we did not encounter "Desktop PC and Notebook PC" as one of information sources in timeline and behavior datasets. This might be due to the age distribution who was the majority of elderly people.

In this situation the Tsunami Warnings, including precautions and advice, reach local residents only by radio, although unreliable and contradictory information can still reach them via cell phones. This reduces information reliability.

Electricity is most likely to be cut when a big earthquake hit, so the possibility of the situation in Figure 5.1 and Figure 5.2 occurring is very high.

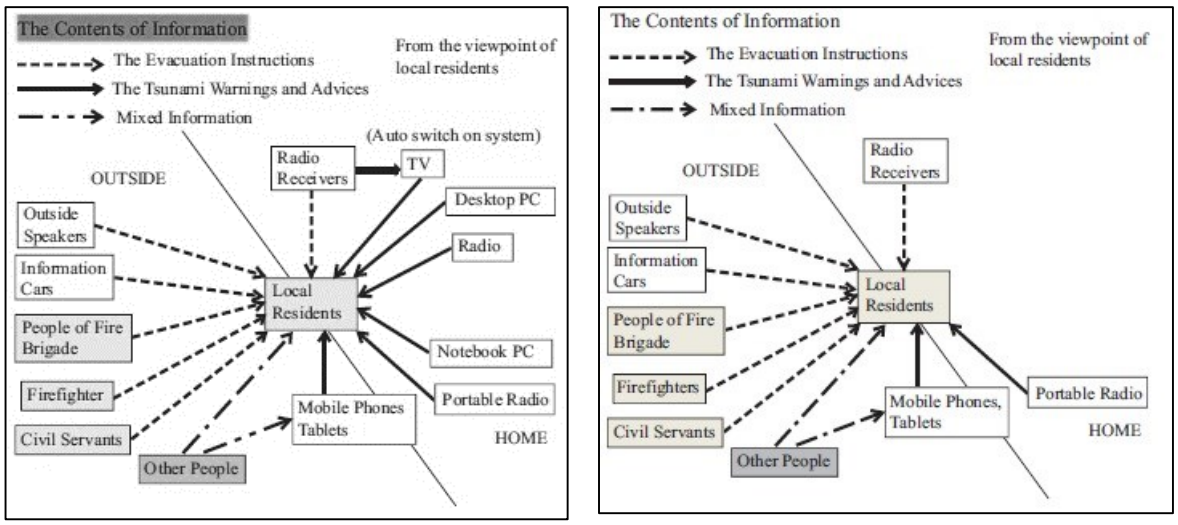


Figure 5.2 Arai's model on Information dissemination with electricity and without electricity (2013)

In addition, cell phones connections and internet cut a few minutes after a disaster happens in order to reduce heavy traffic and often to keep the public service lines alive (Arai, 2013). Therefore, in this situation, the voices of outside speakers, information cars, and officials (fire brigade, firefighters, and civil servants) operating play a very important role in the evacuation of local residents.

5.2 Comparison with the Framework

5.2.1 Information Needs

In this study, we separate two definitions of information needs, (i) Passive Information Needs is the behavior which receiving or subjected to an action without responding or initiating an action in return, and (ii) Active Information Needs is the

act of actively seeking information in order to answer a specific query. Each of information needs can be accessed through different channels and sources.

In our findings, we found that local residents expected authorities to provide early warning of earthquake and tsunami hazards. The biggest number of passive information needs type was on warning (n= 55). They expected warning such as earthquake early warning (EEW) and tsunami warning through some channels and sources, to be clear and specific about the severity of the hazard, its location, and timing.

On hazard severity, local residents needed and expected information about the level of danger the earthquake and tsunami would pose to their households. For example, in both passive and active information needs, they possessed post-tsunami supplies and equipment. They asked for water, gasoline, food, and clothes distribution.

On location and timing, local residents expected information to be tailored and relevant to their geographical area or special circumstances. Ultimately, residents needed and expected warnings to provide information that they can act on or that includes what action they should take. In a comprehensive review of the research on early warning, Mileti and Sorensen (1990, pp. 3–8) conclude that both the content and the style of the warning message determine its effectiveness. They identify five content and five style attributes that should be considered. (i) 'Hazard' refers to content that describes the event as well as how that event would pose a danger to people. (ii) 'Location' content should provide sufficient details that are easily understood. (iii) 'Guidance' refers to advice about what people should do to maximize their safety. (iv) 'Time' refers to indicating how much time is available for preventive actions. (v) 'Sources' refers to identifying sources in order to increase message credibility. Alongside these content attributes, stylistic aspects of specificity, consistency, accuracy, certainty, and clarity should be considered.

This warning message could then be evaluated by viewing the specificity of the message regarding location, guidance, hazard, and time; the consistency of the message regarding these same content factors; and so on. Most of local residents indicated explicitly that they needed information about the location and timing of the hazard, accompanied by guidance on what action to take especially when earthquake and tsunami happened in one time. It is similar with our findings that local residents did not have access to phone and electricity to get exact location, guidance, hazard and time. Local residents also wanted messages to be specific (with regard to location, time, and nature of hazard), clear, and consistent.

5.2.2 Information Channels

Sometimes, the definitions of information channels and information sources can be confusing. In this work, we defined information channels as a tool or a medium from which people get information, for example, phone. While information sources as a person or an organization, for example, family.

In passive information needs, the most used channel during the disaster was mainly from “television” category (n= 55). Television category divided into two category, inside or outside (in-car television). While in active information needs, the most used channel during the disaster was mainly from “phone” (n= 29) such as mobile phone and public telephone. In our findings, television was used for passive information needs because people was in the inside or doing something in work hours. On the other hand, in active information needs, people want to know the situation of their relatives. Most obviously, information associated with can be looked up in increasingly rich channels of interest points.

To compare our findings to previous work that learned of the flood (Ryan, 2013), they found news or weather websites were key followed by radio and television during flash flood. While in slow flood, television and radio were the key

alertors. However, she found that social networking sites was one of the least used resources.

These findings research confirms that there are some differences what channels people get information in disaster. However, it also shows while channels is different, the importance of different channels to information seekers is the same across each type of disaster. In addition, it demonstrate the advantages of oral document to understand detail information seeking behavior over social networking sites data.

5.2.3 Information Sources

Savolainen's (2008) hypothesis that the initial source of information would be returned to as a primary source was not reflected in the results of this study of disaster information-seeking in disaster. However, the organization of information sources into source horizons by Savolainen was reproduced in this study. Savolainen's model also addressed source preferences criteria. Including this aspect of the model into this study was outside the scope of the project and therefore not included in this research. In the earthquake and tsunami hazards, the source horizons appeared this way:

In passive information needs, the most used source during the disaster was mainly from "family/neighborhood" category (n= 69). It includes family, friend, neighborhood, and other people. Same thing happened in active information needs, the most used source during the disaster was mainly from "family/neighborhood" (n= 34). It showed that through this, we know people can choose which sources (passive or active) they want to use. In disaster situation where panic circumstances happened and trust has deteriorated, the ability to make this choice can prove valuable. Additionally, we found that people mentioned their close relatives in order to support the evacuation instruction, disaster information, warning notification and to look for other relatives' conditions.

The information sources data often provided with formal notification that can be used in various ways. Most obviously information can provide rapid sources of information about a developing crisis, their informal nature and their often short format mean that they are unlikely, on their own, to provide sufficient information to maximize their potential value. Taking account of this study, existing information sources should also be incorporated. Such sources could include more static sources such as “Local Governments”, and more formal content describing the location of the incident including details such as geographic or toponym features.

Our findings has similar findings of flood situation (Ryan, 2013). It indicated other people such as family, neighborhood and colleague, as somewhat very or most important source of information they were in touch with these people.

5.2.4 Information Seeking

One interesting feature of information-seeking behavior during post-disaster of the 2011 the Great East Japan Earthquake and Tsunami is the disconnection between the huge volume of warnings and alerts that were broadcast and the residents’ relative lack of preparation and recognition of how severe the earthquake and tsunami hazard would be. As described earlier, warning information was of high quality, often conveyed by persons of authority, and attracted significant media attention. At the same time, many residents were caught by surprise, and a majority of survey respondents indicated that they received no official warning, or that the warnings were not helpful.

For some residents, based on our findings, we suggest that a form of normalcy bias may have been at work during the period leading up to the event. When people are facing a disaster, they tend to interpret their situations as “normal” (i.e., not unusual) even though disaster warnings have been issued. These

perceptions do not change unless people are confronted with undeniable physical evidence that a disaster is imminent or experience social pressure to reinterpret the situation (Turner, Nigg, & Paz, 1986). Even when the information presented is unambiguous, there is a tendency to await confirmation from alternative sources (or simply watch out for what others are doing) before deciding on protective action. The normalcy bias thus refers to the tendency of people to underestimate the probability of a disaster occurring and its dangerous effects (Omer & Alon, 1994), or the tendency in any type of crisis for people to initially interpret their situation as safe and secure (Kuligowski & Gwynne, 2008). Individuals tend to believe in the less alarming options whenever they are presented with conflicting or ambiguous information about danger (Omer & Alon, 1994). Mileti and O'Brien (1992) also introduced the concept of a "normalization bias" to explain why persons without any disaster experience are more reluctant to personalize risk and respond to warnings. To counter the normalcy bias and allow for suitable preparation it is necessary to deliver timely, repeated, and unambiguous warnings and instructions.

In our findings, we used Everyday Information Seeking Behavior (ELIS) model by Savolainen (2008). However, the problem with Savolainen's classification of the importance of sources was that it made the source groups very general. With reference to this study, information-seeking in disaster area, this puts a risk the usefulness of research as a decision-making tool for communicators. For instance, Savolainen's classification networked sources could cover many sectors and it would not be evident to anyone but the researcher that the preference in a particular case might be family/neighborhood. For this reason, in this study sources will be classified in order to test Savolainen's feedback component, but sources will not be grouped for other analysis.

In addition, many of the information-seeking challenges have been noted by Hagar (2010). These challenges include the relative importance of informal and formal channels; the experiencing of uncertainty due to a lack of specific information or information that was conflicting; and getting the right information

to right person at right time. While official, authoritative sources are important, the 2011 Great East Japan Earthquake and Tsunami showed that informal, trusted social sources such as family, friends, and neighbors are often more critical as the first sources of warning information that is relevant to the location and circumstances of the resident. In crisis situations, therefore, residents act as information sources as well as information seekers.

According to the actionable risk communication model (Wood et. al., 2012), the most effective communicators and motivators for preparedness are not public officials, but rather community members who share information about what actions they have taken to guard against risks with others who are less prepared. We can therefore expect local community meetings and the use of social networking sites and tools to substantially improve the effectiveness of warning information seeking and sharing.

5.3 Limitations

We have several limitations to our study:

1. For more challenge on information behavior study, we need to explore more about demographic analysis.
2. Due to the complex nature of oral documents written in Japanese, we had to examine the documents for many times. Inconsistent coding about information seeking behavior in disaster, especially in the timeline annotation, might have affected the actor descriptions of their event descriptions.
3. Findings of this study are limited because of the exploratory nature of the study and sampling. Recruitment of the reports through the oral documents of a government, affiliated with one of the most prestigious journalism media in the country, skewed the sample to a group of adult

and dominantly local people. The oral documents in the present study are not generalizable to the overall population of the Japan.

4. Since data collection took place on the collecting documents and input to the system in the lab, there were some limitations for defining the real situation naturally.
5. There were certain indications of the impact of temporal disaster phases covered in oral documents to know the information flows and dissemination. We were cautious about this effect and tried to collect data within a short of period of time. However, we were unable to fully control the time frame for data collection and the exposure of very large annotation.

Chapter 6
CONCLUSION

6.1 Conclusion

As demonstrated in this research, we confirm that through oral documents, we know people can choose which channels and sources (passive or active) they want to use. In disaster situation where panic circumstances happened and trust has deteriorated, the ability to make this choice can prove valuable. Additionally, we found that people mentioned in oral documents used to support the warning phase as they maintained practices, but also modified practices, which led to structural changes in their society. We also found that people in oral documents that extended beyond the warning phase of Powell's model, even while threat phase was still ongoing in the society.

We propose that oral documents became a medium through which citizens could "re-imagine" their society. By integrating oral documents into their daily repertoire, we were able to extend their physical capabilities despite the restrictions imposed on them in the physical world. People were able to create and experience the version of society that they wanted. Thus, oral documents served the needs of each individual, where it acted as an extension of "real life", an alternative to what was taking place in the physical world, and as a tool to support the recovery process.

6.2 Further Research

Suggestion for future research will be focusing on:

1. We could add more oral documents that represents different people behavior such as more information about location, timing, and disaster type Mileti and Sorensen (1990, pp. 3–8)

2. We could analyse more detailed temporal. At this time, we only used warning and threat of disaster phase from one researcher's findings. In the next study, we will use comprehensive temporal analysis of disaster phase.
3. We need revision and verification of information seeking behavior in disaster areas. In this study, we just used oral documents as primary data source. More complex data analysis, we hope to conduct a longitudinal study is required to confirm or refute findings. It also give advantages to make better contribution of crisis informatics, disaster supporting system and policies.

Acknowledgements

I would like to thank the following people for their support during my Master.

First of all, I thank my supervisors, Prof. Hideo Joho for his patient support, encouragement, and friendly relationship throughout this thesis project. Also for Prof. Tetsuya Shirai for his guidance in the early work and for providing a number of unique oral documents for this thesis project. I am truly fortunate to have you two as my supervisors.

Secondly, I thank to my scholarship provider, the LPDP (Indonesia Endowment Fund for Education, Ministry of Finance, Republic of Indonesia). They were supported my financial during my master study. Any opinions, findings, and conclusions described here are the author's and do not necessarily reflect those of the sponsors.

Third, I thank my family for giving me a permission to study abroad. My thanks also go to all of my friends that I cannot mention their names one by one. They were my dope when I was completely in every breaking down points.

Finally, my thanks also go to the current and past members of the Graduate School of Library, Information and Media Studies in University of Tsukuba, Japan.

List of References

A. Tapia, K. Bajpai, B. Jansen, J. Yen, and L. Giles. (2011). Seeking the trustworthy tweet: Can microblogged data fit the information needs of disaster response and humanitarian relief organizations. In *Proceedings of the 8th International ISCRAM Conference*, pp. 1–10

Alliance Strategic Research. (2011). *Social Media in the 2011 Victorian Floods*. Office of the Emergency Service Commissioner: Melbourne

American Red Cross. (2011). *Social Media in Disasters and Emergencies*. American Red Cross: Washington

Arai, Kyoko. (2013). How to transmit disaster information effectively: A linguistic perspective on Japan's Tsunami Warnings and Evacuation Instructions. *International Journal of Disaster Risk Science*. September 2013, Volume 4, Issue 3, pp. 150-158, http://dx.doi.org/10.1007/s13753-013-0016-8

Bates, M. J. (1989). The design of browsing and berrypicking techniques for the online search interface. *Online Review*, 13(5), pp. 407-424

Buckland, M.K. (1991). Information as thing. *Journal of the American Society for Information Science*, 42(5), pp. 351-360

Carletta, Jean. (1996). Assessing agreement on classification tasks: The kappa statistic. *Computational Linguistics*, 22(2), pp. 249–254

Case, DO. (2008). *Looking for Information: A Survey on Research on Information Seeking, Needs, and Behavior, 2nd edn, Library and Information Science*. UK: Emerald, Bingley

Clemens, R. & Cushing, A. L. (2010). Beyond everyday life: Information seeking behavior in deeply meaningful and profoundly personal contexts. *Proceedings of the Association for Information Science and Technology*, Pittsburgh PA.

Chandra Prabha, Lynn Silipigni Connaway, Lawrence Olszewski, Lillie R. Jenkins, (2007). What is enough? Satisficing information needs. *Journal of Documentation*, Vol. 63 Iss: 1, pp.74 - 89

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London: Sage Publications

Charmaz, K. (2014). *Constructing grounded theory*. London: Sage

Chatman, E. A. (2000). Framing social life in theory and research. *The New Review of Information Behaviour Research: Studies of information seeking in context*, 1, pp. 3-17

Choo, C. W. and Nadarajah, I. (2014), Early warning information seeking in the 2009 Victorian Bushfires. *Journal of the Association for Information Science and Technology*, 65: pp. 84–97. doi: 10.1002/asi.22952

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. London: Sage

Cohen, E. Hughes, P & White, PB. (2007). Media and bushfires: A community perspective of the media during the Grampians Fires 2006. *Environmental Hazards*, vol. 7, no. 2, pp. 88-96

Dervin, B. (1992). From the mind's eye of the user: The Sense- Making qualitative-quantitative methodology. In J.D. Glazier, & R. R. Powel (Eds.), *Qualitative research in information management* (pp. 61-84). Englewood, CO: Libraries Unlimited

Drabek, T. and McEntire, D. (2003). Emergent Phenomena and the Sociology of Disaster: Lessons, Trends and Opportunities from the Research Literature. *Disaster Prevention and Management*, 12, 2, pp. 97-112

Dynes, R. R. 1970. *Organized Behavior in Disaster*. Heath, Lexington, MA

Fu, K-w, et..al. (2010). Enabling the disabled: media use and communication needs of people with disabilities during and after the Sichuan Earthquake in China. International Journal of Emergency Management, vol. 7, no. 1, pp. 13

Fink, A. (2002). How to manage, analyze, and interpret survey data. Thousand Oaks, Calif: Sage Publications.

Fisher, K. E. (2009). *Theories of information behavior*. Medford, N.J: Information Today

Fisher, K.E., Durrance, J.C., & Hinton, M.B. (2004). Information grounds and the use of need-based services by immigrants in Queens, NY: A context-based, outcome evaluation approach. *Journal of the American Society for Information Science & Technology,* 55(8), pp. 754-766

Frohmann, B. (2004). Documentation redux: prolegomenon to (another) philosophy of information. *Library Trends*, 52(3), pp. 387-407

Frohmann, B. (2006). Revisiting "What is a document?. *Paper presented at the Annual Document Academy Meeting, Berkeley*, CA

Glaser, B. G., & Strauss, A. L. (2012). *The discovery of grounded theory: Strategies for qualitative research*. New Brunswick, N.J: Aldine Transaction

Gomez, Oscar A., (2013). Lessons from international students' reaction to the 2011 Great East Japan Earthquake: The Case of the School of Engineering at Tohoku University. *International Journal of Disaster Risk Science* 4(3), pp. 137-149

Hagar, C. (2010). Farmers' search for information during the UK foot-and-mouth disease crisis – what can we learn?. *Australian Journal of Emergency Management,* vol. 25, no. 4, pp. 4

Hagar, C. (2007). The information needs of farmers and use of ICTs. In B. Nerlich, & M. Doring (Eds.) *From Mayhem to Meaning: Assessing the social and cultural impact of the 2001 foot and mouth outbreak in the UK* (ESRC Science in Society Programme). Manchester, UK: Manchester University Press

Hagar, C. (2010). Introduction to crisis informatics. *Bulletin of the American Society for Information Science and Technology*, 36(5), pp. 10–12

International Union of Geodesy and Geophysics., Cummins, P. R., Kong, L. S. L., & Satake, K. (2009). *Tsunami science four years after the 2004 Indian Ocean Tsunami*. Basel: Birkhäuser

Jannica Heinström, Jannica. (2005). Fast surfing, broad scanning and deep diving: The influence of personality and study approach on students' information-seeking behavior. *Journal of Documentation*, Vol. 61 Iss: 2, pp. 228 – 247

Kanai. M., and T. Katada. (2011). The Discussion on the Social Correspondence for Inducing Residents' Evacuation from Tsunami Attacks – From the Actual Evacuation Conditions at Chile Earthquake in 2010. *Disaster Information, Japan Society for Disaster Information Studies:* No. 9: pp. 103–113 (in Japanese)

Kendra, James M., Tricia Wachtendorf, and E.L. Quarantelli. (2003). The Evacuation of Lower Manhattan by Water Transport on September 11: An Unplanned Success. *Joint Commission Journal on Quality and Safety* 29(6), pp. 316-318

Kuligowski, E.D., & Gwynne, S.M.V. (2008). The need for behavioral theory in evacuation modeling. In W. Kingsch, C. Rogsch, & A. Schadschneider (Eds.), *Pedestrian and evacuation dynamics* (pp. 721–732)

Lachlan, K, Spence P and Nelson, L. (2008). *Running Head: age, gender and information seeking.* NCA, San Diego, California, 21-24 November

M. Imran, S. Elbassuoni, C. Castillo, F. Diaz, and P. Meier. (2013). Extracting information nuggets from disaster-related messages in social media. *In 10th International Conference on Information Systems for Crisis Response and Management*

M. Mendoza, B. Poblete, and C. Castillo. (2010). Twitter under crisis: Can we trust what we rt?. *In Proceeding of the KDD 2010 Workshop on Social Media Analytics*, 2010

Mackenzie, M.L. (2005). Managers look to the social network to seek information. *Information Research,* 10(2) Retieved 2th June 2015 from http://informationr.net/ir/10-2/paper216.html

Margaret Ostrander, Margaret. , (2008). Talking, looking, flying, searching: information seeking behaviour in Second Life. *Library Hi Tech*, Vol. 26 Iss: 4, pp. 512 - 524

McKnight, Michelynn. (2007). A grounded theory model of on-duty critical care nurses' information behavior: The patient-chart cycle of informative interactions. *Journal of Documentation*, Vol. 63 Iss: 1, pp.57 – 73

Mileti, D.S., & O'Brien, P.W. (1992). Warnings during disaster: Normalizing communicated risk. *Social Problems,* 39(1), pp. 40–57

Neal, D. M. (1997). Reconsidering the Phases of Disaster. *International Journal of Mass Emergencies and Disasters*, 15, 2, pp. 239-264

Omer, H., & Alon, N. (1994). The continuity principle: A unified approach to disaster and trauma. *American Journal of Community Psychology*, 22(2), pp. 273–287

O. Norio et. al. (2011). The 2011 Eastern Japan Great Earthquake Disaster: Overview and Comments. *Int. J. Disaster Risk Sci*. 2, pp. 34

Gómez, Oscar A. (2013). Lessons from international students' reaction to the 2011 Great East Japan Earthquake: The case of the school of engineering at Tohoku University. *International Journal of Disaster Risk Science*. Volume 4, Issue 3 , pp 137-149. DOI 10.1007/s13753-013-0015-9

Palen, L., S. Vieweg, J. Sutton, S.B. Liu & A. Hughes. (2007). Crisis Informatics: Studying Crisis in a Networked World. *Third International Conference on e-Social Science*, Ann Arbor, Michigan, October 7-9, 2007

Palen, L & S. Liu. (2007). Citizen Communications in Crisis: Anticipating a Future of ICTSupported Participation. *Proceedings of the ACM Conference on Human Factors in Computing Systems CHI 2007*, pp. 727-736

Pettigrew, K.E., Fidel, R. & Bruce, H. (2001). Conceptual frameworks in information behavior. *Annual Review of Information Science and Technology*, 35, pp. 43-78

Pirolli, P. & Card, S. (1999). Information foraging. *Psychological Review*, 106(4), pp. 643-675

Powell , J. (1954). *An Introduction to the Natural History of Disaster*. Univ. of MD: Disaster Research Project

Quarantelli, EL. (1998). Social Science Study of Disasters and Mass Communication – a Historical Account of the Field. In L Masel Walters, L Wilkins & T Walters (eds), *Bad Tidings: Communications and Catastrophe.* Lawrence Erlbaum and Associates: Hillsdale, New Jersey

Quarantelli, E. L. (2002). The Disaster Research Center (DRC) Field Studies of Organized Behavior in the Crisis Time Period of Disasters. In R. A. Stallings (Ed.) *Methods of Disaster Research* (pp. 94-126). International Research Committee on Disasters

Ryan, Barbara and Amalia Matheson. (2010). Significance of communication in emergency management. *The Australian Journal of Emergency Management*. Volume 25, No. 01, January 2010. www.em.gov.au/Documents/Ryan+%20+Matheson.pdf

Ryan, Barbara. (2013). Information seeking in a flood. *Disaster Prevention and Management,* Vol. 22 Iss: 3, pp. 229 – 242

S. Vieweg, A. Hughes, K. Starbird, and L. Palen. (2010). Microblogging during two natural hazards events: What twitter may contribute to situational awareness. in Proceedings of *ACM Conference on Computer Human Interaction* (CHI), April 2010

Saldaña, J., Saldaña, J., & Miles, M. B. (2013). *The coding manual for qualitative researchers + qualitative data analysis: A methods sourcebook*. London: Sage Publications

Savolainen, R. (1995). Everyday life information seeking: Approaching information seeking in the context of way of life. *Library & Information Science Research*, vol. 17, no. 3, pp. 259-94

Savolainen, R. (2010). *Everyday life information seeking. Encyclopedia of Library and Information Sciences*, Third Edition, 1: 1, pp. 2735-2746

Spink, Amanda and James Currier. , (2006). Towards an evolutionary perspective for human information behavior: An exploratory study. *Journal of Documentation*, Vol. 62 Iss: 2, pp. 171 – 193

Stallings, R. and Quarantelli, E. (1985). Emergent Citizen Groups and Emergency Management. *Public Administration Review*, 45, pp. 93-100

Stallings, R (Ed). (2002). *Methods of Disaster Research*. Int'l Research Committee on Disasters

Stallings, R.A. (2006). Methodological Issues in H. Rodriguez, E. L. Quarantelli, & R. R. Dynes (Eds.), *Handbook of Disaster Research* (pp. 55-82). New York: Springer

Stoddard, E. R. (1968). *Conceptual Models of Human Behavior in Disaster*. Texas Western Press: El Paso

Talja, S., Tuominen, K. & Savolainen, R. (2005). Isms in information science: constructivism, collectivism and constructionism. *Journal of Documentation*, 61(1), pp. 79-101

Taylor, R.S. (1991). Information use environments. *Progress in Communication Sciences*, (10), pp. 217-255

Tierney K, Lindell MK and Perry RW. (2001). *Facing the Unexpected: Disaster Preparedness and Response in the United States*. Washington, DC: Joseph Henry Press

Tuominen, K., Talja, S. & Savolainen, R. (2002). Discourse, cognition, and reality: toward a social constructionist metatheory for library and information science. In H. Bruce, R. Fidel, P. Ingwersen, & P. Vakkari (Eds.), Emerging frameworks and methods; *Proceedings of the Fourth International Conference on Conceptions of Library and Information Science*. (pp. 271-283). Greenwood Village, CO: Libraries Unlimited

Turner, R.H., Nigg, J.M., & Paz, D.H. (1986). *Waiting for disaster: Earthquake watch in California*. Berkeley, CA: University of California Press

Turner, Deborah. (2010). Can a Document be Oral?, hicss, pp.1-8, 2010 *43rd Hawaii International Conference on System Sciences*, 2010

Turner, Deborah. (2012) Oral documents in concept and in situ, part I: Grounding an exploration of orality and information behavior. *Journal of Documentation,* Vol. 68 Iss: 6, pp. 852 – 863

Turner, Deborah. (2012). Oral documents in concept and in situ, part II: managerial decrees. *Journal of Documentation*, Vol. 68 Iss: 6, pp. 864 – 881

Varga, I., Sano, M., Torisawa, K., Hashimoto, C., Ohtake, K., Kawai, T., Oh, J.-H. & Saeger, S. D. (2013). Aid is Out There: Looking for Help from Tweets during a Large Scale Disaster. *ACL (1) (p./pp. 1619-1629), : The Association*

for Computer Linguistics. ISBN: 978-1-937284-50-3. http://www.aclweb.org/anthology/P13-1159

Weisenfeld, G. S. (2012). *Imaging disaster: Tokyo and the visual culture of Japan's Great Earthquake of 1923*.

William S. Hemmig, (2008). The information-seeking behavior of visual artists: a literature review. *Journal of Documentation*, Vol. 64 Iss: 3, pp. 343 – 362

Williamson, K. (1998). Discovered by chance. The role of incidental information acquisition in an ecological model of information use. *Library and Information Science Research,* 20(1), pp. 23-40

Wilson, T. D. (2000). Human information behavior. *Informing Science*, 3(2), pp. 49-55

Wilson, T.D. (1998). Models in information behavior research. *Journal of Documentation,* 55(1), pp. 3-50

Wimmer, RD and Dominick, JR. (2000). *Mass Media Research: An Introduction*,. Wadsworth Publishing Company: Belmont, California

Zumthor, P. (1990). The presence of voice. *In Oral poetry: an introduction*. (pp. 3-10). Minneapolis, MN: University of Minnesota Press