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# How do personal connections play a role in risk perception of climate change and sea level rise?

Katelyn Sheeley

## ABSTRACT

The threat of sea level rise is unknown to many coastal residents living in the United States, including Virginians. Climate Central, a nonprofit research-based organization, has created the *Risk Finder* tool to help inform the public about the potential dangers posed by sea level rise. *Risk Finder* is an interactive, online mapping tool intended to inform residents of useful data concerning sea level rise. Dr. Daniel Richards and Mrs. Megan Mckittrick from Old Dominion University acted as primary investigators for a study of the *Risk Finder* tool, serving client Dan Rizza of Climate Central. Students of ENGL 231C served as secondary investigators for observation and transcription of results. This civic learning project consists of usability testing conducted on Climate Central's new *Risk Finder* tool. Investigators of this project reached out to residents of Hampton Roads via informational flyers to request participation in the research study and the survey questionnaires following. Research sessions were conducted with a total of 8-10 participants, an ample sample size for this type of research. Participants were interviewed before and after they used the Climate Central website, and were observed in their unstructured use of the *Risk Finder* tool for the allotted time. These usability tests serve the client, Dan Rizza, by providing useful feedback to Climate Central, including potential enhancements to make the *Risk Finder* tool more efficient and useful for the public. Results from this research help researchers in the field of study to better understand methods to communicate information on sea level rise to citizens in a way that connects with the public.

Usability testing of climate change and sea level rise tools provides data that benefits both the creators of risk communication tools and the general public, the recipients of risk communication. As climate change, sea level rise, and flood risks continue to pose threats to many communities and ecosystems, the general public needs to become more aware of critical environmental information. The usability testing of risk communication tools contributes to a better understanding of the methods and tactics which are most successful in relaying information from scientists and researchers to the general public. Although climate change and sea level rise have been occurring for many decades, there remains a disconnection in the way people receive, interpret, and understand the complex relationship between climate change and sea level rise. The significance of this usability testing study lies in filling the gap between the presentation of scientific research data and the comprehension of the general public.

This study conducts usability testing on the *Risk Finder* tool to serve client Dan Rizza at Climate Central. The study provides data in regards to communicating information on climate change and sea level rise to the general public effectively. One major theme found throughout the collected data was the impact of risks, especially concerning transportation and family. The theme suggests that when an individual is presented with information concerning climate change and sea level risk perception, they first consider the impact of the risk, or how the climate change or sea level rise problem will affect their personal life. Individuals will most likely react more strongly to climate change and sea level rise if they see how these topics directly affect either the transportation or family criterion.

## **LITERATURE REVIEW**

It is not surprising that people are more likely to believe or become more educated about a topic that directly affects them, their property, or their family. A personal connection serves as a differentiating factor in a person's perception of climate change and sea level rise. Similar to the participants in Huda's (2013) study in Bangladesh where 49% were coastal farmers that were directly affected by sea level rise (p. 4), participants of Carothers' research (2014) were chosen by selective purposive techniques; these techniques were used in order to study participants who had extensive knowledge of specific regions of Northern Alaska, those who had long term residency in the region, and those who had long term participation in specified occupations (p. 2). These constraints were placed on selection of participants in order to achieve the most accurate results. Carothers and her research team discovered that in specific regions of Northern Alaska, 84% of participants consistently agreed that significant climate change was occurring and that it was

affecting the sustenance practices in rural Alaskan communities (Carothers, Brown, Moerlein, López, Anderson, Retherford, p. 5). The results from Huda's research in Bangladesh and Carothers' team's research in Alaska provide evidence that populations in coastal regions, whose careers and lives are directly affected by climate change, substantially agree that climate change is real and happening. This substantial agreement among coastal populations could lead researchers to conclude that geographical location of residency is a major factor in a person's perception of climate change, while also playing a closely related and significant role in the person's vulnerability to the effects of climate change.

### **Geographical Location**

A person must take into account the hazards most common to the region of the world in which they live. For example, the west coast faces the danger of earthquakes while states in the Midwest and Southwest face the danger of droughts. These geographical dangers

or environmental hazards influence the vulnerability of the land region itself and its inhabitants. In terms of this research study on sea level rise and usability testing, consideration is given that coastal regions are at a higher risk of threat due to sea level rise. In a Norwegian coastline study, approximately 110,000 buildings were concluded to be situated less than one meter above normal sea level, and the buildings were grouped into categories of temporary houses and boathouses, houses, garages, cabins, office buildings, hotels and restaurants, and buildings for fishing and agriculture (Almås & Hygen, 2012). Each of these buildings serves a purpose to one or many individuals, relating to the personal connection between citizens and the objects in threat of environmental danger. In the event that these buildings were destroyed by sea level rise, thousands of individuals' lives would be affected. Thus, residents of these coastal areas are more vulnerable to the effects of sea level rise. A separate study in the United States suggests that socially vulnerable communities located in high risk areas for sea level rise

are more likely to experience disproportionately adverse consequences (Martinich, Neumann, Ludwig, Janterasami, 2012). The idea of vulnerability leads people to be more mindful of climate change and its possible adverse effects and causes residents of various areas to be more likely to agree with statements that present climate change and sea level rise as potential dangers (Martinich et al., 2012).

## **Transportation**

Subsequent studies relating to the U.S. Central Gulf, which is defined for this study as the area between Galveston, Texas and Mobile, Alabama, reveal that more frequent extreme precipitation events may disrupt transportation networks with flooding and visibility problems (Pavlopoulos p.1). Relative sea level rise will make much of the existing infrastructure prone to frequent or permanent inundation – 27 percent of the major roads, 9 percent of the rail lines, and 72 percent of the ports are built on land at or below 122



cm (4 feet) in elevation (Pavlopoulos p, 1). Just as in the U.S. Central Gulf, many other areas of the United States are built below sea level. With precipitation, these low areas experience various severities of flooding that cause many transportation routes to be inaccessible. Another study assessed exposure to hurricane storm surge and sea level rise for the U.S. Gulf of Mexico and Atlantic coasts. Sea level rise scenarios ranging from +0.50 to +0.82 meters by 2100 showed increased estimates of the area exposed to inundation by 4–13% and 7–20%, respectively, among different Saffir-Simpson hurricane intensity categories (Maloney p.1). Estimates of the number of housing units currently exposed to hurricane storm surge ranged from 4.1 to 9.4 million for category 1 and category 4 storms, respectively, while exposure for category 5 storms was estimated at 7.1 million due to the absence of land-falling category 5 hurricanes (Maloney p.1). The storm surge research study, along with many other studies, serves as an excellent basis of knowledge for the impacts of sea level rise in the United States. The thousands of

individuals and families that would be directly and indirectly affected by sea level rise, flooding, and storm surges can only be estimated.

## **METHODS**

For the productive usability testing conducted in this study, participation was requested from residents in the Hampton Roads area. Systematic sampling ensured participants were requested from all regions of Hampton Roads and provided a wide population for selecting the sample. After responses were received from potential participants, testing was conducted using a sample of four individuals. Testing sessions and data collection included giving participants a pre-test interview, allowing them to freely use the online tool to see their natural progression through the site's multiple tabs of information, and conducting post-test interviews to achieve a final understanding of participants' reactions and thoughts concerning the tool. During the participants' unstructured use of the

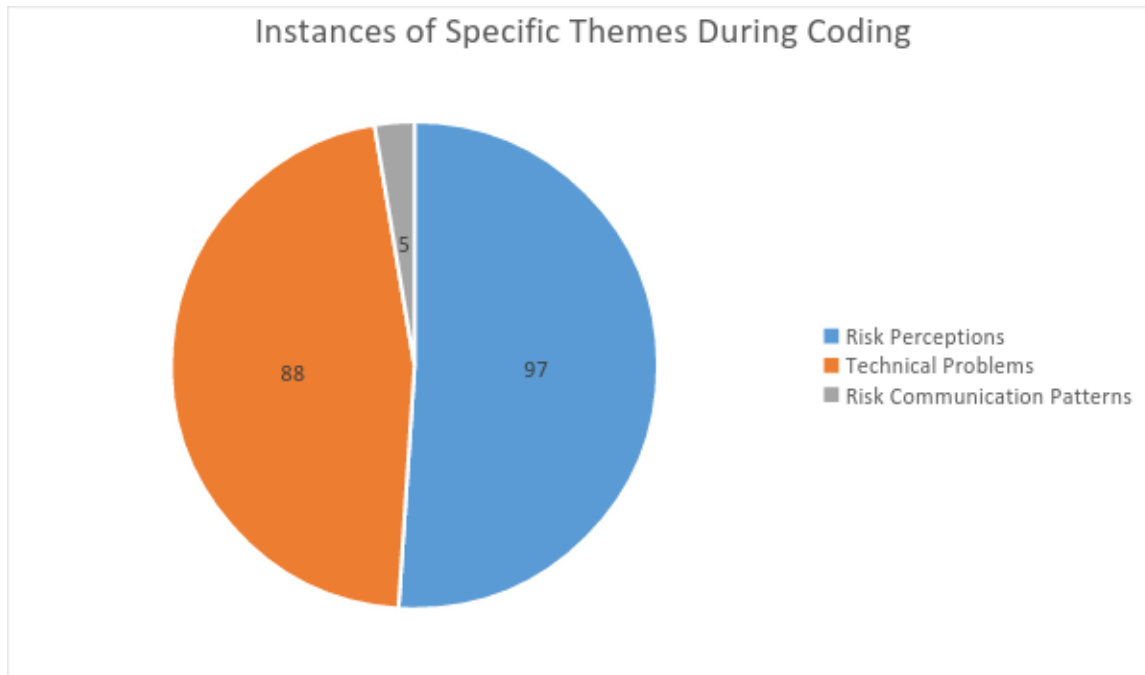
tool, they were asked to follow a think-aloud protocol. Participants stated aloud their thoughts and actions for the duration of the testing as a part of data collection. Following the session, the audio file was transcribed into a word document that was later coded for themes. The themes discovered during the coding process showed the different angles and the complexity of the topic spectrum for the study. The data uncovered in the data analysis and transcriptions serves as a useful tool to better serve the client, Climate Central, in this civic learning project.

## RESULTS

Analysis and coding of the data from productive usability testing of the *Risk Finder* tool displayed many themes. Two major themes were risk perceptions and technical problems, and a third, less prominent theme was risk communication patterns. The themes were measured through tabulation of the "instances" or the number of times a particular idea came up in the transcript. The first theme,

risk perceptions, included smaller coding themes of risks (61 instances) comprised of risks of climate change, flooding, and sea level rise, and a smaller coding theme of the impact of risks (36 instances) with regard to transportation or family. The second coding theme, technical problems, represented any instance of confusion with terminology or usage of the site during the testing sessions with the participants. The third coding theme was concerned with the sources from which participants received risk communication. A chart showing the instances of specific themes from the data is represented in *Figure 1*. In order to better understand the backgrounds of the participants and the collected data, the demographics of the participants were also collected. The demographic information is represented in *Figure 2*.

**Figure 1:**



**Figure 2:**

Name	Date of Birth	Gender	Race/Ethnicity	Years of Residency in Hampton Roads	Computer Proficient Self-Assessment	Education Level	Previous or Current Occupation
Participant A	7/21/1950	F	Black	10+	Highly Proficient	Graduate	Corporate Management
Participant B	12/28/1951	M	White	10+	Highly Proficient	Undergraduate	Government Regulation
Participant C	3/8/1960	M	White	10+	Highly Proficient	Graduate	Federal/Civil Service
Participant D	6/9/1947	M	White	10+	Moderately Proficient	Undergraduate (some)	Electric Technician

## DISCUSSION

Of the themes discovered during the coding process of the audio transcriptions, risk perceptions, with regard to climate change, flooding, sea level rise, transportation, and family, was the theme that was seen the most throughout the transcriptions. The prevalence of the risk perceptions theme is to be expected based on the idea that people are most concerned with what directly impacts their family, their personal property, and themselves. This study's usability testing suggests that a person's perception of an identified risk such as climate change, flooding, or sea level rise is affected by this impact of risks principle. For example, during the unstructured use of the tool during the testing session, Participant A immediately went to the maps tabs to look up the city of Norfolk, where her house is located. Similarly, participant B searched the map for his own neighborhood and used the water table scale to see the damage to his property at different levels of inundation. Both of these instances are examples of participants showing concern for how the

risks of flooding and sea level rise would affect themselves and their families. Participant C serves as an excellent example for an instance where the risk perception of transportation played a factor in how he utilized the tool. Participant C specifically navigated the map to look at a hospital in Hampton Roads where his wife works to see transportation routes and the impacts of sea level rise or flooding on his wife's workplace. These specific instances, only a few of the numerous examples found throughout the hours of transcriptions, suggest participants' perceptions of the risks of sea level rise and flooding are affected by aspects of their personal lives, such as family and transportation.

Considering that the study was an undergraduate research project executed within one semester, some limitations exist. One of the limitations was that only four people participated, resulting in the research being based off data collected from these four participants. For some studies, having only four participants may be a problem; however, the purposes of this study placed more

importance on having participants that fit desired specifications, such as being a resident of Hampton Roads and being willing to participate in the study, than on having a large number of participants. These specifications ensured the quality and credibility of the claims made based off the research.

Usability testing research of the *Risk Finder* tool and the data collected is useful in better understanding the general public's risk perceptions of specific topics, such as climate change. Understanding these perceptions can help better define what methods and tactics work best to convey these ideas to the public through risk communication. Better communication methods will assist in educating and informing the public in a way that will make a lasting impact and hopefully lead to any necessary reform in cases such as climate change, sea level rise, and flooding. Some research questions remain: What is the next step in research of climate change? What is the true cause of the continuous changes in our environment, specifically our oceans and water sources? These



questions alarm some individuals and concern many. Future studies conducted with a similar focus in the field of climate change and risk communication will expand knowledge of these subjects. Increased numbers of studies will make more research accessible to help answer concerning questions and outline the future of climate change, sea level rise, and flooding.

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