Fall 2015

Differences in Individual Perceptions of Volcanic and Seismic Hazards

Justin Elwonger
University of Nebraska Lincoln

Follow this and additional works at: http://digitalcommons.unl.edu/envstudtheses

Elwonger, Justin, "Differences in Individual Perceptions of Volcanic and Seismic Hazards" (2015). Environmental Studies Undergraduate Student Theses. Paper 172.
http://digitalcommons.unl.edu/envstudtheses/172

This Article is brought to you for free and open access by the Environmental Studies Program at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Environmental Studies Undergraduate Student Theses by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.
DIFFERENCES IN INDIVIDUAL PERCEPTIONS OF VOLCANIC AND SEISMIC HAZARDS

by

Justin Elwonger

AN UNDERGRADUATE THESIS

Presented to the Faculty of
The Environmental Studies Program at the University of Nebraska-Lincoln
In Partial Fulfillment of Requirements
For the Degree of Bachelor of Arts

Major: Geology

Under the Supervision of Dr. Leilani Arthurs

Lincoln, Nebraska

December, 2015
DIFFERENCES IN INDIVIDUAL PERCEPTIONS OF VOLCANIC AND SEISMIC HAZARDS

Justin Elwonger

University of Nebraska, 2015

Advisor: Dr. Leilani Arthurs

While there has been significant research done on public perceptions of volcanoes and volcanic hazards, there are gaps in the literature in both studies regarding perceptions of earthquakes and seismic hazards as well as comparative studies on perceptions between tectonically active and inactive areas. This is an exploratory study that aims to lay the groundwork to help fill in some of these gaps. A free-response survey instrument was developed and deployed to populations of college students in Nebraska and Hawaii. Overall, responses showed that the types of perceptions in both locations are quite similar, but the frequency that those perceptions are held differ. Future work involves developing a multiple choice instrument based on the data gathered in this study that will then be deployed to a broader demographic.
Introduction

A hazard is defined as something that poses a threat, while a risk is the potential to lose life, property, or something else of value due to the hazard. In other words, hazards cause a risk. The public is not always as aware of geologic hazards as one might expect (Davis & Ricci, 2004). For example, Barberi et al. (2008) surveyed a population near Vesuvius and found that only seven per cent of the surveyed population perceived the volcano as a hazard. These perceptions can change significantly over relatively short distances. Residents near Etna are largely aware of the risks and are confident in their government officials, whereas residents near Vesuvius report a higher degree of vulnerability and less knowledge of the evacuation strategy (Davis & Ricci, 2004). Additionally, as is the case near Mount Merapi, locals may not view volcanic hazards in the same way as government officials (Dove, 2008).

Even though public conceptions have been previously documented (e.g., Johnston et al., 1999; Mitchell, 2000; Barberi, 2008; Carlino, 2008; Haynes et al., 2008), my review of the literature indicates a gap in the literature with respect to public conceptions of earthquakes and their relationship to volcanic hazards. In addition, comparative studies that investigate potential regional differences in how volcanic hazards and earthquakes are perceived are also lacking. My study aims to address these gaps in understanding by using a mixed-methods approach as described by Cresswell and Clark (2007).

The findings of this study may be important to public policy makers and educators responsible for communicating about the causes and hazards associated with volcanoes and earthquakes (e.g. Cronin et al., 2004; Dominey-Howes and Minos-Minpoulos, 2004; Dove, 2008; Lavigne et al., 2008). Public safety is a major concern at both the local, state, and federal levels (e.g., McLoughlin, 1985; Waugh, 1994; Mileti, 1999).

When it comes to volcanic disaster preparedness, the traditional approach tends to focus efforts on predicting the likely type and size of eruption and on monitoring the volcano. The preparedness of the population itself is typically not considered to as great of an extent (Barberi, 2008). This leaves the public at greater risk, as a failure to understand the risks involved might lead the public to fail to take the necessary actions or even over rely on experts and government officials (Carlino, 2008; Barberi, 2008).

This is an exploratory study whose primary purpose is to (i) identify the types of conceptions that college students in two regions with very different levels of volcanic and seismic activity (Nebraska and Hawaii) have about the hazards associated with volcanoes and earthquakes and (ii) determine whether there are any possible differences in these conceptions as a function of region.

Materials and Methods

This study complies with all IRB guidelines. As part of this exploratory study, a survey instrument was developed to collect information about people’s conceptions of hazards associated with volcanoes and earthquakes. This survey instrument is comprised of both open-ended items and multiple-choice items. To examine the validity of the survey and to refine it,
information collected from think-aloud interviews with experts and novices as well as responses to a pilot test of the survey were used to iteratively refine the items and enhance the survey’s overall validity.

We targeted the college-aged demographic for our surveys. Survey respondents were 17-28 years old and lived all of their life or the majority of their life in Nebraska or Hawaii. Due to funding limitations, we employed purposive sampling for our survey.

In Nebraska, think-aloud interviews were conducted with novices and experts. Novices were recruited via emails sent out to various classes, and interviews took place in the GRASCE lab. Experts were recruited by inviting professors within the Earth and Atmospheric Sciences Department and interviewed in their offices. The interviews involved the interviewee reading the survey questions aloud, restating the question in their own words, and then answering the question. When necessary, the interviewer would ask for the interviewee to elaborate upon or clarify their answer. Audio recordings of these interviews were collected, used to fill in the potential gaps in the interviewers' notes, transcribed and archived along with the interviewers notes, and then deleted. Novic participants were compensated $10. Expert interviewees were not compensated.

In Hawaii, novice interviews were conducted in a quiet and safe space. Expert interviews were conducted in offices at the Hawaiian Volcano Observatory, as all of the expert interviewees were staff at the volcano observatory. Interviewee recruitment in Hawaii was based largely off of personal connections between the interviewee and the lead PI. The interview process was the same one used in Nebraska. Hawaiian participants were not compensated.

After the survey was developed, it was administered to college students in two geographically different places with different degrees of geologic hazards associated with volcanoes and earthquakes – Nebraska and Hawaii. I used purposive or convenience sampling in this study due to the exploratory nature of the study and to the limited funds available for it.

In Nebraska, surveys were administered to three classes. Arrangements were made with the course instructors prior to administering the survey. The PIs administered the surveys in the classrooms. Participation did not affect the students’ grades, and they were notified of this prior to being surveyed. The surveys were paper-based, and the consent forms were attached to the front of the survey. The PIs received the surveys from the students as they were completed. The incentive drawing for three gift cards was held after all of the Nebraskan surveys had been collected.

In Hawaii, classes were surveyed the same way they were in Nebraska. However, due to a limited number of students enrolled in summer courses at the University of Hawaii at Hilo (UHH), participants were also recruited from public areas on the UHH campus, primarily in and around the library. In these cases, the PIs described the research to potential participants and asked if they would like to participate. Those who chose to participate completed the survey in the area where the PIs recruited them. The PIs also surveyed the public in front of the local supermarket with the proprietor’s permission.
After surveys were collected, they were screened for participant demographics and completeness. Surveys that were not mostly complete and/or that were completed by individuals who were not 18-26 years old were omitted from the analysis. The responses were then transcribed and digitized for ease of data analysis.

The methods used for data analysis used a mixed methods approach as described by Cresswell and Clark (2007). The qualitative data collected from the open-ended survey items underwent a textual analysis and be coded using the MaxQDA software package, to identify common categories that emerge from the data. An iterative process was be used to refine the coding rubric applied to each of the open-ended items. Inter-rater reliability was be used to determine the reliability of the coding rubric as well as the applied codes. After the qualitative data had been coded and categories with numerical data generated, the numerical data from both the open-ended items and the multiple-choice items was analyzed to determine whether significant differences exist between respondents from the two regions and whether there are any potential correlations between responses to different items.

Results

When asked what the primary cause of volcanic eruptions are, 50.9% of Nebraskan respondents listed tectonic plate activity compared to 41.9% of Hawaiian respondents. Pressure buildup was the second most common response with 28.4% of Nebraskan respondents and 28.7% of Hawaiian respondents. Magma was stated as the primary cause by 13.8% of Nebraskan respondents and 23.5% of Hawaiian respondents, and earthquakes were listed by 6.0% of Nebraskan respondents and 9.6% of Hawaiian respondents. Other responses included atmospheric changes, heat, hot spots, activity in the Earth’s core, water interacting with magma, and chemical reactions. These results are summarized in figure 1.

Participants were then asked about the hazards from volcanic eruptions that are the largest threat to them, 77.7% of Nebraskan responded with ash compared to 61.6% of Hawaiian. Lava flows were the second highest response in both locations with 47.3% of Nebraskans and 59.6% of Hawaiians. Volcanic gases were listed by a mere 5.3% of Nebraskans, but 31.0% of Hawaiians. However, when asked how likely it is that they would be affected by a volcanic eruption, 73.2% of Nebraskans stated a less than 50% chance, 18.8% reported a 50% chance, and 8.7% reporting a chance larger than 50%. Hawaiians, on the other hand, were much more spread out across the board with 27.8% reporting a chance under 50%, 29.1% reporting a 50% chance, and 44.4% reporting a chance over 50%.

Participants were also asked what the primary cause of earthquakes are. An overwhelming 90.7% of Nebraskan respondents stated that tectonic plate activity is the main cause of earthquakes. Volcanic activity was not mentioned at all by Nebraskans as a cause of earthquakes, but was given as the cause by 12.9% of Hawaiians. The other responses were pressure buildup, fracking, atmospheric changes, faults, subsidence, heat, and the movement of rock; all of these had response rates of 2% or lower. These results are summarized in figure 2.

When asked what hazards associated with earthquakes are the greatest threat, 35.4% of Nebraskans and 40.3% of Hawaiians reported property damage. Falling buildings were
mentioned by 40.0% of Nebraskans and 27.8% of Hawaiians, and tsunamis were listed by 14.6% of Nebraskans and 43.1% of Hawaiians. When asked how likely it is that they will be affected by these hazards, 66.2% of Nebraskans reported a chance under 50%, 23.3% reported a 50% chance, and 10.6% reported a chance greater than 50%. In Hawaii, 47.3% reported a chance over 50%, 37.3% reported a 50% chance, and 10.5% reported a chance lower than 50%.

The most popular sources of knowledge of volcanoes and earthquakes that respondents gave were science class (87.2% of Nebraskans and 68.3% of Hawaiians), the media (16.5% of Nebraskans and 23.5% of Hawaiians), and firsthand experience (2.3% of Nebraskans and 20.0% of Hawaiians).

When asked to report how confident they felt about their knowledge of volcanoes, 93.2% of Nebraskans and 95.4% of Hawaiians reported some degree of self-confidence. Participants were less confident in their knowledge of earthquakes, with only 55.9% of Nebraskans and 74.8% of Hawaiians reporting some degree of confidence. Participants were also asked about their level of confidence in the scientific community’s understanding of volcanoes and earthquakes, to which 72.8% of Nebraskans and 83.6% of Hawaiians reported some level of confidence.
Figure 1. Respondent's perceived causes of volcanic eruptions. \((n_{\text{NE}} = 140, n_{\text{HI}} = 154)\)

Figure 2. Respondent's perceived causes of earthquakes. \((n_{\text{NE}} = 140, n_{\text{HI}} = 154)\)
Discussion

One of the biggest differences between regions were the volcanic hazards that participants felt they would be affected by. Ash was the biggest concern in Nebraska, being listed by 78% of respondents. In Hawaii, lava flows and volcanic gases were the greatest concern, mentioned by 60% and 58% of respondents respectively, with ash being mentioned by 54% of the population. This is actually what we expected; lava flows and gases do not directly threaten Nebraskans, but ash clouds from volcanoes farther away could affect people in Nebraska. Similarly, lava flows are a more direct threat to Hawaiian, and volcanic gases affect many people on the Big Island on a daily basis.

While Nebraskans were generally unconcerned about volcanic hazards, Hawaiians were much more evenly distributed in their level of concern. Many of the respondents that said volcanic activity will probably not affect them reasoned that the active flows are on the side of the island opposite that that they currently live on, but a handful of respondents did not appear aware that the Big Island of Hawaii is volcanically active.

The overwhelming majority of respondents in both locations said that tectonic plates were the primary cause of earthquakes (95% of Nebraskans and 91% of Hawaiians). However, very few actually described how tectonic plates lead to earthquakes. This leads us to believe that many students are learning about the causes of earthquakes, but many lose their comprehension of the material and only retain buzzwords.

Nebraskans and Hawaiians generally gaining information on volcanoes and earthquakes from similar sources, with respondents in both locations listing some type of science class as their source of knowledge (87% of Nebraskans and 68% of Hawaiians). However, firsthand experience was more commonly reported in Hawaii than Nebraska (2% of Nebraskans, 20% of Hawaiians). We expected this difference, however, as Hawaiians encounter volcanic activity much more often than Nebraskans.

The majority of participants in both locations reported some degree of confidence in their understanding of volcanoes (93% of Nebraskans and 95% of Hawaiians). However, the number of participants reporting some level of confidence in their knowledge of earthquakes is much lower (56% of Nebraskans and 75% of Hawaiians). This drop in confidence shows in the questions on the survey asking about how volcanoes and earthquakes work; while many participants were able to articulate how they imagined volcanic eruptions occurring, many of the responses when we asked about the cause of earthquakes were simply, “Tectonic plates.”

Participants were also asked about their confidence in the scientific community’s understanding and interpretation of volcanoes and earthquakes. A high percentage of respondents in both locations reported some level of confidence (73% of Nebraskans and 84% of Hawaiians). The slightly lower percentage from Nebraska might be due to differing levels of outreach; residents in Hawaii are very close to the Hawaii Volcano Observatory, and scientists from the observatory do a considerable amount of outreach to the public. Nebraskans, on the other hand, see very little outreach from the scientific community regarding volcanoes and earthquakes.
Overall, participants in both locations seemed to have the same perceptions of volcanoes and earthquakes and the hazards associated with them. What seemed to differ between locations was the frequency that those perceptions were held. What may have been the most popular response in Nebraska was the second most popular in Hawaii, for example.

**Conclusion**

In the demographic we surveyed, differences between populations were not as high as expected. Any differences we did see made sense given the context, such as participants in differing locations feeling threatened by different hazards. The types of perceptions of volcanic and seismic hazards held by both populations are very similar, but the frequency with which these perceptions are held differ. Further research will involve revising the survey into a multiple choice survey based on the responses received from the free response survey and then deploying it to a much more broad population.
Literature Cited


