Evaluating emotional responses to framing of climate change maps with facial emotion recognition technology

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Abstract

Maps are a powerful means by which to communicate the science, impacts, and mitigation strategies of climate change through their ability to congruently represent the spatial disparities of climate change across space. These types of visuals can be emotional through their illustration of places where impacts will be most devastating to society. Indeed, climate change communication literature has identified the need to appeal both to readers need for information as well as their emotions for communicating the complexity of climate change. How visuals, such as maps, are framed in policy reports and news articles has bearing on readers emotions and how these visuals are understood. However, despite calls for evaluating emotional responses to maps, little research has focused on emotional framing of maps. This research addresses this gap through an experiment and survey on Amazon Mechanical Turk to identify how different frames lead to different emotional responses. This study illustrates a method by which to identify emotional responses to maps and climate change framing, and will identify the ways in which emotional responses differ depending on framing and prior beliefs when viewing maps with different frames.

1998 ACM Subject Classification http://www.giscience.org/

Keywords and phrases emotion recognition, climate change, map design, framing, Amazon Mechanical Turk

Digital Object Identifier 10.4230/LIPIcs.GIScience.2018.

1 Introduction

Maps are a powerful means by which to communicate the science, impacts, and mitigation strategies of climate change through their ability to congruently represent the spatial disparities of climate change across space. This power of maps for communicating climate change can also be emotional. Map readers can visually identify where impacts will be most devastating and what that means for society. In addition, different cartographic designs have been shown to lead to different emotional responses [7]. Indeed, climate change communication research has identified that simply providing more information about climate change is not sufficient in eliciting pro-environmental behavioral responses [11]. Instead, emotional connections to climate change and the environment is what is often identified as necessary for pro-environmental behaviors. Thus, it is this emotional framing of climate change information that can potentially change behaviors and lead to pro-environmental responses. However, despite calls for evaluating emotional responses to maps [8], little research has focused on emotional framing of maps especially in the context of serious problems for the environment and society.

We address this gap in the literature through evaluating different emotional responses to different emotional frames in the context of climate change through the use of real policy

reports which were submitted and shared with US Congress in 2009 and 2012. In 2009, The United State Global Change Research Program (USGCRP) published a report on Global Climate Change Impacts in the United States [17]. Three years following that publication, the neoliberal think-tank The CATO Institute published what they advertised as an addendum to the original USGCRP report [4]. With nearly identical covers and page layouts, these reports are hard to distinguish between, except in their differing perspectives on the causes and impacts of a changing climate. The USGCRP report reports on a synthesis of scientific findings which point to humans causing the changes, and the urgent need to mitigate and adapt to changes and impacts. The CATO report does two things: 1) It denies that humans are the cause of climate change with little to no scientific backing, and 2) situates that even if the climate is changing that it can and should be recognized as a good thing, especially in an economic context. Across the two reports, maps are used to illustrate the impacts of climate change in the United States. Interestingly, the CATO report uses many of the same graphics, including maps from the USGCRP report. However, the two reports use different framing of these maps and graphics to make their differing arguments.

It is these two policy reports which form the basis of our stimuli in this study to evaluate the different emotional responses of map readers in the context of climate change. Specifically, we ask four research questions:

1. Do climate change beliefs predict the type of emotion people experience when viewing a news article or map about climate change effects?

2. Does the framing of a climate change map influence emotion toward a news article or map about climate change effects?

3. Does the type of emotion people experience when viewing maps and news articles about climate change effects influence action?

4. How do perspectives on climate change influence feelings about the credibility of the map and news article about climate change effects?

We addressed these research questions through a between-subjects online survey and experiment using Amazon Mechanical Turk (MTurk) which incorporated both open- and close-ended questions, as well as facial emotion recognition software. Participants were asked about their demographics, political ideology, beliefs about climate change, their emotions toward the information they read in the survey, whether they would donate to an environmental group based on the information they read and viewed, and how they felt about the credibility of the source of information in the stimuli. Finally, during the reading of news articles and viewing of the maps, participants were recorded with their own webcams. The video footage was analyzed with facial emotion recognition software to identify emotional responses to the different frames and maps.

2 Background

Increasingly, there have been calls from cartographers from both the critical and cognitive sides of cartographic research to better understand the connection between emotions and mapping. Cartographers can facilitate community mapping efforts and participatory methods to map emotion and emotional experiences in space, and increasingly we are seeing the need to identify what types of emotions are elicited by different map designs [3] [7] [8]. Emotional responses to maps are tied to how people read and interpret the information presented, and is seen as a missing aspect in the nearly 70 years of research in cognitive cartography following in the Arthur Robinson tradition [3] [10]. This work dovetails onto work about the rhetoric and persuasiveness of maps whereby emotions are a key aspect in the persuasiveness of a

message or in the design of certain types of maps [16] [12]

In the realm of climate change communication, emotion has been identified as an important aspect necessary for pro-environmental behaviors [9]. This stems from the connection between affect and cognition necessary to form attitudes [1]. Pooley and O'Connor indicate that what people feel and believe determines attitudes [14]. In addition, Moser /citemoser identifies that often cognition is the focus of climate change communication while affect lays absent. Instead she identifies that emotion is a key component of climate change communication and needs to be given equal weight in scientific communication studies.

One way in which emotion is conveyed through text is through framing. Framing as defined by Entman [6]. He describes it as: "involve[ing] selection and salience. To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and or treatment recommendation for the item described."

It is through framing a particular issue that a topic can elicits emotion in the reader.

Much of the research on emotional framing, as it applies to climate change, has been conducted by psychologists and focuses on fear appeals (for review: [11]). Fear appeals are emotional frames for information that are designed to evoke fear in readers. These types of appeals have been shown to be particularly useful when readers have control over the issue communicated [5]. For instance, fear is effective in messages that are used in smoking cessation campaigns. In this case, fear often is effective towards changing behavior. However, these types of appeals have been shown to backfire in climate change communication because group effort is necessary as opposed to individual behavioral changes. When fear appeals are used for climate change communication, audiences often note that they are overwhelmed with the need for a widespread collective effort leading to a failure to do anything [13].

On the other hand, some research in the psychology domain has called for the use of empathetic perspectives to engage the public on the issue of climate change [2] [15]. This requires readers to embrace the position or perspective of others. Indeed, recent research has shown that empathizing has been effective towards pro-environmental behaviors and may be particularly effective for non-environmentalists [15]. In particular, in the Swim and Bloodhart study, [15]the emotion of hope was particularly effective in participants feeling their behavior was helpful. It is these positive emotions that are necessary towards pro-environmental behaviors in ways other types of emotion lead to in-action.

3 Methods

To test emotional responses to different frames about climate change, I developed a human-subject online map experiment which will be conducted using MTurk and Qualtrics in June/July 2018.

3.1 Participants

Participants will be recruited using MTurk. These participants, called "workers" in the MTurk space, will be those with a webcam and over 97 percent reputation on the MTurk site who have completed over 1000 HITs to assure that they have experience as workers. Respondents will be paid two US dollars for their time to complete the study. The study will include an attention check to assure the participants are not randomly clicking through the survey and experiment. Attention checks are simple questions included in the study which have a clear correct answer that all respondents will be able to answer.

3.2 Materials

Each participant will answer a series of pre-test questions which focus on: 1) where the participant gets their news, 2) their geographic knowledge related to the places in the maps they will see in the experiment, and 3) their familiarity with the topics displayed in the maps in the subsequent experiment.

Participants will then be randomly assigned to one of two framing conditions: the USGCRP report frame or the CATO report frame. The USGCRP frame is highly scientific, states that climate change is human-caused, and illustrates the need to urgently mitigate and adapt. The CATO frame is focused on denying climate change or propagating doubt in the science, and illustrates that climate change, even if it is happening, can be viewed as a positive for the US economy. Each participant will read three fake news articles based on either the framing of the USGCRP report or the CATO report. Included in these fake news articles are the real maps which were nearly identical between the two reports.

The participant will read and view the news articles and maps based on framing condition. The participants will then answer a series of questions. These questions focus on whether participants view the map and the article to be credible, and what emotion they feel and how intensely they feel that emotion when they read the article and look at the map.

Finally, after completing three sets of experimental questions for each of the three news articles, the participants will conclude the study by answering a set of post-experiment questions related to demographic and prior beliefs about climate change. The final question will ask participants whether they would like to donate their MTurk payment to an environmental organization to identify the connection between emotion an action.

3.3 Procedure

The study will be conducted at the participants own home computer space. Through the MTurk website, workers will be directed to a Qualtrics survey. Participants will be provided with an informed consent form and will type their name to indicate they have agreed to the terms of participation. Once the survey commences, the participant's webcams will be turned on to create a recording of their face while they participate in the experiment. Participants will work their way through the survey and experiment by answer the pre-experiment questions, reading the fake news articles and answer the experiment questions, and then finally will finish with the post-experiment questions.

The recordings of the participants will be analyzed with Intraface, a facial emotion recognition software to identify the dominant emotions elicited by the participant when viewing and reading the news articles and maps. Intraface allows researchers to identify five emotions (happy, surprised, neutral, disgusted, and sad) from video, and compare this emotion information with the other data collected in the study.

4 Preliminary Results and Discussion

Currently I have conducted a pilot test of the materials and procedure with two pilot research participants. These preliminary results indicate that facial emotion recognition can be used in cartographic research for understanding emotion responses to visual and textual stimuli. The results illustrate that different stimuli do lead to different responses within participants (i.e. the emotion recognition software was able to distinguish different emotion responses when participants viewed different news articles).

Results from the full study will illustrate the ways in which emotions vary between different frames about climate change information between participants. In addition, the full study will illustrate the ways in which climate change beliefs, views of credibility, as well as frames moderate the emotions experienced by participants. Finally, this study will allow us to understand the connection between emotion and pro-environmental behaviors given prior beliefs and understandings of climate change.

5 Summary

Understanding the connection between maps, framing, and emotion has implications for how information about climate change is processed by readers. Maps are particularly powerful means by which to convey information about a changing climate, but how these visual forms are framed may have serious implication for how they are read and viewed by map readers depending on the emotions elicited by the text surrounding these maps. This study illustrates a method by which to identify emotional responses to maps and climate change framing, and will identify the ways in which emotional responses differ depending on framing and prior beliefs when viewing maps with different frames.

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