Beyond Biased: Exploring the Relationship between Map Design Style and Map Reader Persuasion

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ABSTRACT: Overtly persuasive maps – i.e., those purposefully designed to sway an audience to a particular point of view about the data being mapped – are different from scientific visualizations – i.e., those meant to present data accurately and intuitively for logical analysis. Yet, little is known about how effective different map designs and rhetorical styles used in persuasive maps are at actually convincing an audience. It has been proposed that at least four types of persuasive map rhetoric exist – propagandist, sensationalist, understated, and authoritative. In this paper, results of a preliminary study testing the efficacy of these different rhetorical styles to convince map readers that nuclear power is dangerous are briefly reviewed. Using the knowledge gained from that study, and omitting several shortcomings, a more robust and larger research project is outlined that will further explore the impact of a map's rhetorical design on shaping map reader opinion. Several datasets dealing with social and environmental issues were chosen to be mapped and are reviewed here. Unlike the aforementioned study, the data to be presented to subjects is not life threatening, nor does it potentially have a direct impact on subjects' lives. It is believed that the results from this proposed study may differ due to the more mundane nature of the data. The new research project and methodology are outlined and a call is made for more studies on the role of map design and rhetorical style for persuasive argumentation.

KEYWORDS: map rhetoric, persuasive maps, map survey, map interpretation, map trust

Introduction and Literature Review

Maps are a form of visual communication. There are, however, many styles and types of visual communication. Maps take numerous guises depending on communicative goals of their producers. Perhaps at their most primitive, maps can be used to show where things are in relationship to one another – i.e., a reference map. With detailed data, reference maps can be used to show people how to get from one place to another. Beginning in the 1600s, though not becoming common until the late 1700s, maps became tools for presenting thematic spatial data (Robinson, 1982). With developments in technology and data collection, thematic mapping has evolved dramatically from merely being a tool for presentation to also being a useful tool for data exploration and knowledge creation (DiBiase, 1990).

As a form of communication, all maps make arguments about the data they are presenting (Wood & Fels, 1992); that is, all maps are rhetorical. As maps have become common communication tools for informing and explicating complex spatial relationships among myriad datasets, academic researchers tend to exalt the merit and importance of data

accuracy and the elimination of perceived bias from representations. Striving for objectivity and accuracy in one's cartographic representations is itself a form of rationalist rhetoric. Rationalist argumentation, however, is not the only form of rhetoric that can be employed by map producers.

Indeed, not all maps are designed to make rationalist, logical arguments – some are created to convince or persuade using other means (Tyner, 1982). Often a map maker may want to communicate a position or belief and the spatial data simply do not support the argument. Just because one cannot make a rational argument given a spatial dataset does not mean one cannot make the argument using a map; it simply implies that another, less logical and more emotive rhetorical approach will probably be more effective at convincing an audience to see one's side of an argument. Indeed, even when datasets support one's argument (e.g., anthropogenic global climate change is happening), rationalist arguments may not resonate effectively with intended audiences (i.e., climate change skeptics and doubters in the public at large). An exemplar of using an unconventional, completely illogical, though emotively striking, approach to make a cartographic argument is found in Figure 1. *The Man of Commerce* map was produced in 1889 by a company in Superior, Wisconsin, hoping to promote the city as a central location for international trade and business. This map does not use statistics or a rationalist logic to imply the potential greatness of this port city; instead, it makes an eccentric, if not downright unsettling, analogy between global trade and human anatomy. Superior, Wisconsin, is transformed into the heart of global trade, whereas Chicago is merely a piece of liver. One cannot help but feel some empathy for the area unfortunate enough to be labeled "pubes."
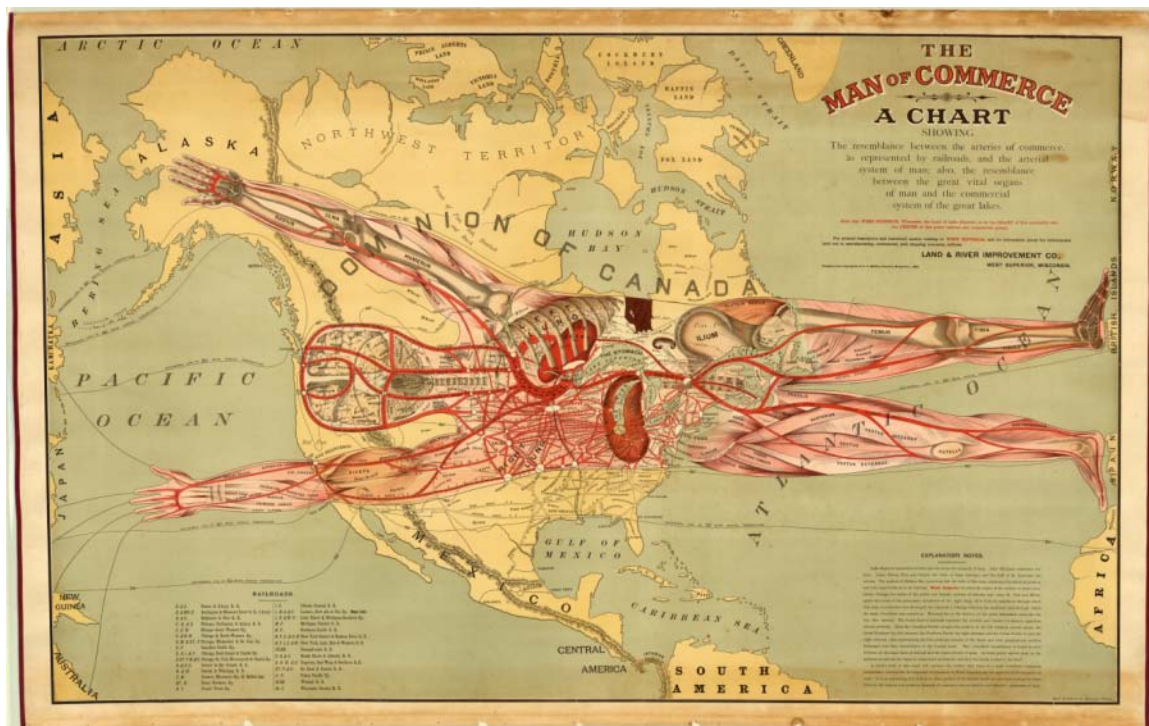

Figure 1. *The Man of Commerce* by Land & River Improvement Company, Superior, Wisconsin, 1889. From the American Geographical Society Library, University of Wisconsin – Milwaukee Libraries.

An abundance of research demonstrates that maps are not always concerned with making arguments by exposing facts in an objective manner but instead are concerned with convincing an audience. Exemplars from throughout history have been analyzed, scrutinized, and critiqued by cartographers and social scientists for their design, role in society, and impact on social norms (see for example Akerman, 2002; Wood & Fels, 1986). Such maps are often categorized as promotional maps (Akerman, 2002), news maps (Balchin, 1988; Monmonier, 1989), political maps (Black, 1997; Zeigler, 2002), propaganda maps (Monmonier, 1991; Pickles, 1992), and more recently, radical maps (Denil, 2011). Propaganda maps seem to have seized the most attention, with numerous case studies of state produced maps in the literature (G. Herb, 1999; G. H. Herb, 1989; Monmonier, 1991; Pickles, 1992).

However, much of the cartographic research on persuasive maps has treated them as curios, examples of wayward, disingenuous cartography (see for example earlier works such as Boggs, 1947, and Speier, 1941). Typically, exemplars of propaganda or advertising maps from throughout history are selected and analyzed post facto as case studies. Though such studies are extremely enlightening and important, particularly for analyzing the role of maps in previous public discourse, they tell us little about how to effectively design emotive and convincing maps for our own audiences.

Problem Statement

The research project outlined and discussed here, though not yet complete, takes a different approach to studying rhetorical cartography – i.e., maps designed with the sole goal of convincing map readers to take a particular stance in the argument being communicated. Rather than focus on previous map examples and speculate as to the impact persuasive representations may have had on people in the past, it is proposed that we can intentionally design and test the impact of different persuasive map designs on contemporary map readers.

Little is currently known about the efficacy of different rhetorical map styles for the persuasion of audiences. Knowing more about which cartographic and design techniques are most effective in eliciting particular reader emotive responses will benefit cartographers tasked with designing maps that not only inform but convince. Certainly, there is a risk that such knowledge may be used by villainous cartographers to disenfranchise or hurt people, but the surfeit of literature cited heretofore seems to indicate that this has been and continues to be the case regardless. On the positive side, exploring effective rhetorical map design will help scientists, policymakers, and the average lay cartographer design maps that better resonate and articulate the arguments being made with, or without, data. Indeed, one of the key problems scientists have in contemporary society is convincing the public to trust and take logical arguments seriously (Olson, 2009). Humans are not often logical and rational creatures; frequently, emotional connection is more convincing than reams of well visualized data ever would be. The hypothesis underlying this research is that different map rhetorical styles – rationalist, emotive, demonstrative, etc. – will achieve different persuasive goals in a given audience depending on what type of argument is being made.

Identifying Map Rhetorical Styles

Some effort has been put forth in recent years to more systematically begin analyzing variation in map design and style in large datasets. Edsall (2007) used content analysis to look at iconic maps found on bumper stickers and t-shirts. Kessler and Slocum (2010) used the same method to compare change in thematic map design between several journals. Muehlenhaus (2011) also used the method to look at change in representation in *Goode's World Atlas* over the years. Most pertinently to this study, Muehlenhaus (2010) used content analysis to analyze how political cartographic manipulations (i.e., persuasive maps) are constructed and to categorize their rhetorical design.

Muehlenhaus (2010) has argued that persuasive maps have at least four broad rhetorical styles. Using quantitative content analysis on 251 overtly persuasive maps, and analyzing 192 different variables on each map, he found that the maps in his sample clustered into four groups. He named the groups by their rhetorical characteristics: (a) Sensationalist; (b) Propagandist; (c) Understated; and (d) Authoritative.

Sensationalist maps are characterized by several core features, including the representation of myriad (and often irrelevant) datasets, superfluous illustrations or photographs, oblique perspectives, dynamic representation, and often mimetic symbolization. They often have incendiary titles; though, this is not requisite. Muehlenhaus labeled them sensationalist due to the fact that they attempt to overwhelm the cognitive capabilities of map readers with a variety of visual distractions and exciting design quirks. They tend to sensationalize the data being represented.

At first glance, propagandist maps may appear similar to sensationalist maps. However, they rarely use more than two datasets, whereas sensationalist maps use multiple ones. Propagandist base maps tend to be simplified, highlighting the main argument being presented. These maps make their arguments concisely, eliminating most extraneous data and map elements that do not add to the message. Data detail is diminished, often down to the nominal level of measurement. When used, titles are often inflammatory. Superfluous illustrations are less common on these maps, though iconic and mimetic symbolization is often used.

Understated maps are simple, often minimalist, direct representations of one or two datasets. They are called understated because at first glance, it may not appear that the maps are making an argument at all. Typically, a variety of data-model techniques have been used to manipulate what is being presented on the map. This "invisible manipulation" never makes itself obvious to the map reader. The visual representation of the map itself is often clean and unobtrusive. It is rarely dynamic; typically, the map presents data in an extremely static manner. Illustrations are almost never used. Map elements are left to a minimum – typically a neatline, title, and legend are included, less commonly a scale bar.

Finally, authoritative maps are those that are designed to look scientific, accurate, and reliable. Such maps tend to strictly adhere to the tenets of academic cartography. This rhetorical style is that most commonly used by scientists and policy makers. Authoritative maps often have insets and charts, shaded relief and numerous layers of

data. They are more likely to include sources, information about projections, extremely detailed base maps, and scientific or official sounding titles. By looking official, scientific, and like accurate replications of reality, these types of persuasive maps are ideal for persuading audiences who respect authoritative presentations – even if the data being presented is anything but accurate.

Testing Persuasive Rhetorical Map Design, 1.0

One study testing the different effects of Muehlenhaus' rhetorical styles on map readers has been completed. In the initial study, Muehlenhaus created four maps of fake hypothetical nuclear disaster data in the United States (see Figure 2). A preliminary study of the impact of rhetorical style on audience map interpretation, trust of data, map recall, and map likability was conducted using an online survey of the four maps.
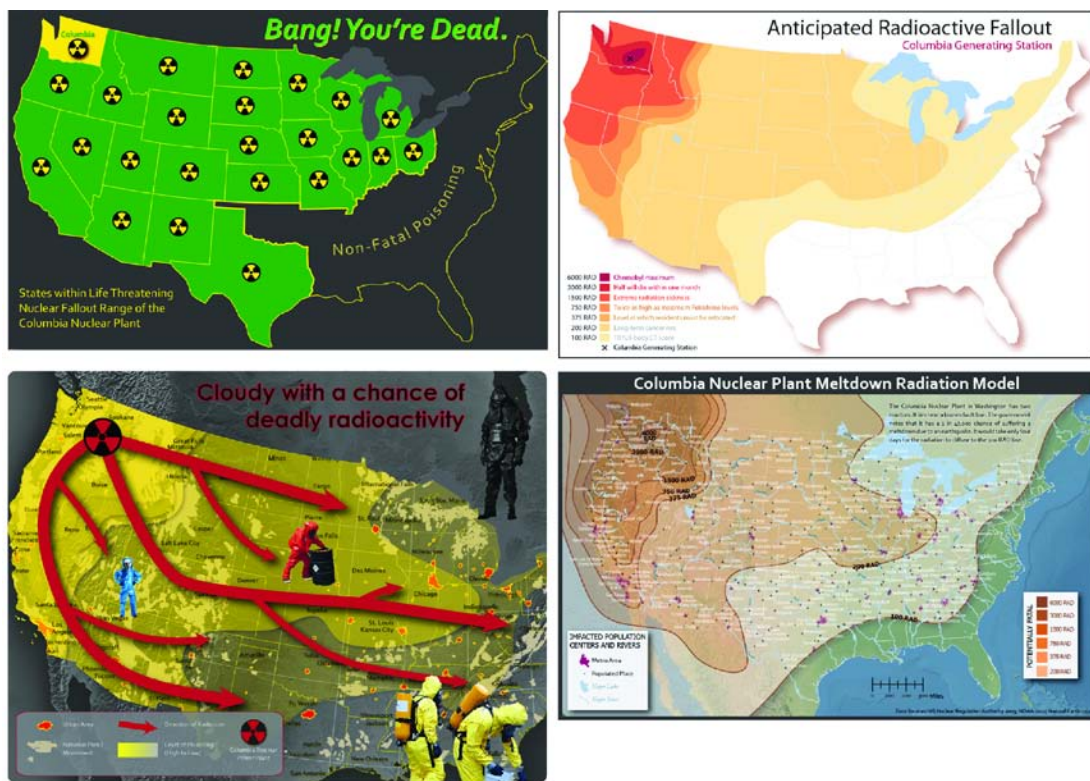

Figure 2. Muehlenhaus' four representations of *fake and embellished radiation data* should the Columbia Nuclear Power Station in Washington state melt down. Clockwise from top-left: Propagandist map, Understated map, Authoritative map, and Sensationalist map.

The survey was broken down into three parts. In the first part, survey respondents were asked a variety of questions about their background, their self-assessed knowledge concerning nuclear power, weather patterns, and the physical geography of the United States, and also about their feelings regarding nuclear power. In the second part, each respondent was randomly assigned one of the four maps and asked to look at it for as long as they liked. They were then asked to recall how much radiation their zip code would be exposed to according to the map. They were also asked to identify how much of the United States was exposed to life threatening radiation. They also recorded

confidence levels in their answers. They were tested to see if and how their opinions of nuclear power changed after viewing the map. They were asked whether they believed the data used was accurate and whether they felt the map was biased. Most of the responses were recorded using a five-point Likert scale. This allowed for non-parametric analysis of the results to test for variation and statistical significance of answer correlation. In part three of the survey, each respondent was shown all four of the maps and asked to look at them for as long as desired. They were then asked to rank the maps based on which one they trusted the most, which one they thought was the most stylish and had the best design, and which one they believed they would recall best one month from the date of the survey.

The results of this preliminary study (currently under peer review for publication) yielded some statistically significant findings that contradict several core axioms of quantitative visualization as postulated by Tufte (1983, 1991). First, with regards to the nuclear maps at least, it was found that subjects were more convinced by maps that presented less data, not more. Moreover, people viewing maps with less data were significantly more confident in their responses than those viewing maps with a high data-to-ink ratio – regardless of how accurate their responses about data on the map actually were. Second, the results appeared to show that maps subjects found to be overtly biased were *not less* persuasive but actually *more convincing* than those appearing to be objective. Finally, the map that was considered least stylish – the propagandist map in this case – was also the one that subjects overwhelming felt they would recall one month later. The conclusion: in the case of nuclear disaster data, at least, if you want people to remember the argument you are presenting, it may be wise to use an overtly biased title, embellished and gaudy imagery, an obnoxious color palette, and less data. Essentially, it may be wise to disregard many of the tenets of graphical excellence as defined by Tufte (1983). The results of this study correlated with previous findings that found professional graphic designers frequently disregard Tufte's axioms when they are designing quantitative visualizations to impress people of import (Tractinsky & Meyer, 1999).

Merely the Beginning, Not an End

This initial inquiry into the efficacy of different map rhetoric in convincing people to be anti-nuclear power was not without its limitations. To begin with, the data were completely false. The radiation levels were grossly embellished. Second, the study was based on fear. There is already a deeply rooted fear among many people concerning radiation sickness and poisoning due to common knowledge about different nuclear disasters (e.g., Fukishima, Chernobyl, Three Mile Island, Bikini Atoll, Nagasaki, and Hiroshima). Moreover, news reports of the danger of nuclear weapon proliferation are largely unavoidable in the United States. In summary, convincing American subjects to be anti-nuclear power via a map of fake data that shows half of the United States being exposed to deadly radiation is not necessarily a very difficult or revealing test about which rhetorical style is most convincing. It is the goal of the forthcoming proposed research to overcome this shortcoming.

Testing Persuasive Rhetorical Map Design, 2.0

The goal of this research project is to begin testing the efficacy of different rhetorical mapping approaches to change map reader opinions concerning non-life or death issues. Convincing people via fear – i.e., attempting to highlight how much danger people are in – is only one type of persuasive map use. This study is interested not in scaring people into a particular position, but rather in testing whether certain rhetorical styles are more effective at gently persuading people to change their minds on social issues about which they may have strong feelings.

Study Set Up

Four separate, real datasets are being mapped four times, each time using a different rhetorical style. These 16 maps are being designed with the specific purpose of attempting to convince people to view particular geopolitical, social, environmental, and conservation arguments in unconventional ways. Three of the datasets are being created by undergraduate students at the University of Wisconsin – La Crosse; the fourth set will be mapped by this paper's author.

The study will begin in Fall 2012 and will be limited to American residents. (This is being done to control for cultural differences and norms regarding the topics.) An online survey is being designed to test map reader trust, interpretation, map style likability, and recall of the different rhetorical styles. The survey (discussed in more detail below) is significantly different from the one used for the study on nuclear meltdown data. As 16 will be evaluated, the goal is to have at least 800 respondents resulting in 50 subjects for each map.

The datasets being mapped were selected to fulfill three criteria. First, they needed to be somewhat controversial; the topics being presented have a prominent place in society. Second, they had to be topics about which most people have somewhat entrenched, though perhaps not well-rounded, opinions. Third, and unlike the previously reviewed study of nuclear meltdown data, the topics chosen were to have minimal direct impact on the daily lives or well-being of those participating in the study. The datasets being mapped, along with several draft maps, are reviewed below.

Series 1 Argument: Norwegian Whaling is a Sovereign Right and Good for the Environment

It is presumed that most Americans are anti-whaling, even though most probably know very little about contemporary whale hunting other than what they watch in the popular television shows. Beginning decades ago, whales became the poster animal of the environmentalist movement in the United States. However, several countries, including Norway, still hunt whales in their sovereign waters. Norway strictly controls the whale harvest of Minke whales, allowing less than 1% of the whales in their waters to be harvested every year. Regardless, many environmentalists are opposed to Norway's continued whaling.

Whaling is a significant part of Norwegian cultural history, similar to deer hunting in the United States. The goal of these maps is to change American map readers' objections to whale hunting and to convince them that Norway should have the right to whale hunt.

Fortunately, there are several things over which the American public tends to consistently concur, which will help in this task. First, many Americans are traditionalists. Second, state sovereignty is often considered key for protecting cultural rights. Conservationists in the subject pool may be moved by data that exemplifies just how controlled the hunts are, ensuring that Minke whales survive forever. Finally, environmentalists might be appeased by data demonstrating that whale meat is greener than any other meat on the market. Not only does whale harvesting result in less carbon emission than standard, land-based meats, it is healthier than red meat. The maps (several drafts of which are shown in Figure 3) in this series will emphasize these different points in an attempt to convince an American audience that, not only is Norway whaling responsibly, it should be allowed to continue whale hunting in the future.
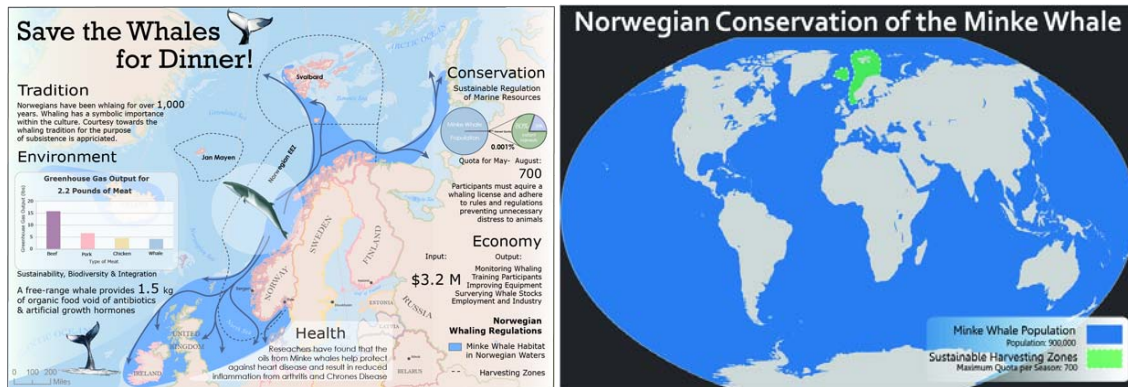

Figure 3. Several draft maps promoting Norway's humane, environmentally friendly, and culturally significant whale harvest. From left: Sensationalist map and Understated map.

Series 2 Argument: the United States is a Bilingual Country and This Should be Recognized

The debate arises every so often in the national consciousness – should the United States officially become a unilingual government. Numerous counties and local municipalities have passed ordinances requiring that all official and legal communication be conducted in English. Though the federal government has largely avoided the topic, discussion over the Spanish language's place in American society has featured predominantly in national debates over immigration. The goal of these maps is to convince those on the fence about unilingual legislation and ordinances to empathize with Spanish-speaking Americans and become anti-unilingual legislation. These maps (see Figure 4) are meant to nix the argument for a unilingual government. It is expected that this map series will elicit a certain level of excitement from those who are pro-bilingualism in the United States and discomfort among those who believe that English should be an official language.

Figure 4. Pro-bilingualism maps. From left: Authoritative map and Sensationalist map.

Series 3 Argument: Nuclear Power is Good for the Environment

To counteract the overt bias of the study done with nuclear disaster maps, which may have inadvertently terrified many subjects into thinking that nuclear power is extremely dangerous to their well being, the third series of this study will attempt to do the opposite. The goal of this series is to promote nuclear power as a bountiful, green, and safer alternative to coal and other fossil fuels. This will likely be a more difficult task. There is an innate fear about nuclear power in the collective subconscious compared to coal. Though coal kills approximately 30,000 people a year due to respiratory disease (Schneider, 2004), and nuclear power kills close to zero, coal may not be viewed by the public as suspiciously as nuclear power. Maps, such as the draft in Figure 5, will attempt to paint coal black.
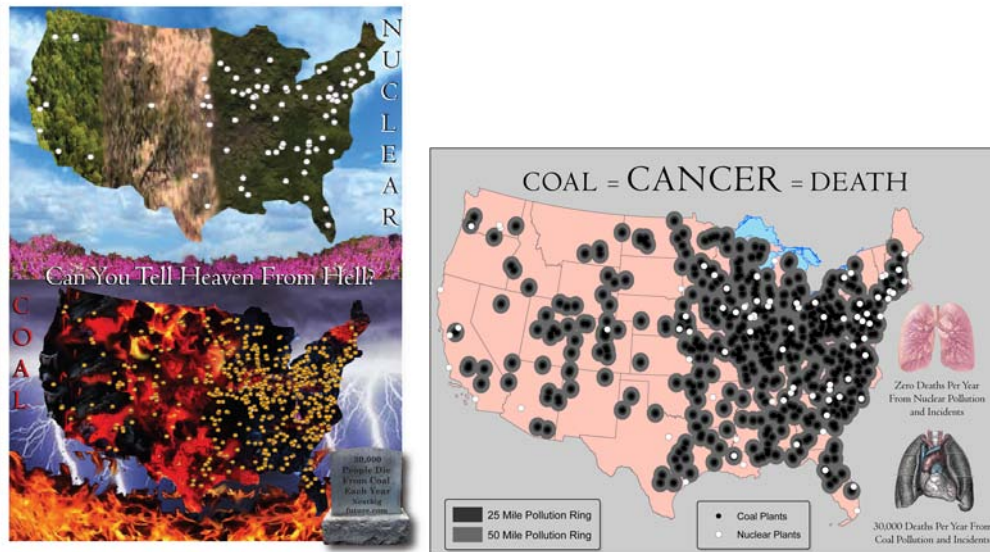

Figure 5. It is hard to sell anything labeled "nuclear" as a good thing, unless you compare it to something that is far more deadly. That is the goal of these maps. From left-to-right: Sensationalist Map and Propagandist Map.

Series 4 Argument: The Chinese Liberation of Tibet Has Been Good for Tibetans

"Free Tibet!" This slogan is common on bumper stickers, in dorm windows, and at concerts around the world. The Dalai Lama is well renowned in Western political circles. However, how deep are American sentiments for Tibetan independence? Do many Americans realize Tibet was an undeveloped theocracy before China liberated it? What if they are shown that historically Tibet has been part of the Chinese Empire, including on United States produced maps representing Asia over the past several hundred years? The goal of these maps is probably the most ambitious – persuade map readers that the Chinese liberation, or what many in the US have been taught to perceive as occupation, was not only just but has also been extremely beneficial for Tibetans. These maps have not yet been produced in draft form for display here.

Survey Creation

The survey to be used in this study has been heavily modified from the one used for the nuclear meltdown study. Several questions, which in hindsight are superfluous and did not yield any meaningful information, will be omitted (e.g., "How many hours a week do you spend playing videogames?"). Several additional questions regarding the data being presented and confidence in responses will be added. Finally, and most importantly, users will not see the same data mapped twice; this was a potential shortcoming in the original study, as respondents were asked to rank four maps showing the same exact data. The survey will be broken down into three parts.

Part one of the survey will be used to collect standard demographic data (e.g., age, sex, political leanings), as well as assess respondent knowledge about the four topics being shown on the maps. Finally, using Likert scales, respondents will also be directly asked about their feelings on the four topics. These responses will be statistically compared to their responses to the same exact question asked after viewing the maps.

Part two of the survey will be broken down into four subsections. In each subsection, respondents will be shown a single map designed using a different rhetorical style from the other subsections (e.g., authoritative, sensationalist, propagandist, and understated). These will be randomly selected from the different map series; subjects will never see two representations of the same data. They will see one map from each map series. After viewing each map individually, respondents will be asked a series of questions dealing with trust, perceived bias, information recall from the map, and confidence in their responses. They will also be directly asked again about their feelings regarding the argument being presented. (This question will be compared with their pre-map responses.) Once they complete answers for a single map they will be shown the next map and so forth.

In part three of the survey, they will be asked a series of questions ranking the four maps based on which one was most aesthetically pleasing, which one they felt was the most accurate and trustworthy, which one they believe they will recall the longest, and which one they believed changed their opinion most. There will also be an open-ended section so that respondents can explicate their thoughts.

Analysis and Expected Results

The use of Likert scales will have several advantages for analysis. First of all, Kruskal-Wallis tests can be conducted on the non-parametric data to test for significance of variation among the different rhetorical styles. Open-ended responses will be analyzed using content analysis to look for significant opinions and views about the map designs that quantitative measurements may fail to highlight.

After analysis, the results will be compared to those from the nuclear disaster study. Moreover, we will have a clearer picture of whether or not these different rhetorical styles have universally persuasive characteristics regardless of the topic of persuasion, or if they are case specific. The results may shed light on when different rhetorical style use is efficacious. For example, if one enters an argument and 80% of the audience disagrees with what is being espoused, perhaps an understated style will be most effective at persuading the audience. In contrast, if most people in one's audience largely agree with the argument being presented, perhaps a sensationalist style will work best.

Based on the results of the previous study, it is expected that the propagandist maps will score highest on recall, and the authoritative maps will be trusted more than the other rhetorical styles. Other aspects of this study are exploratory, though, and no predictions can be made as to what the results will be. For example, it will be interesting to see if maps can significantly change a study group's opinions regarding any of these controversial topics. If so, will different rhetorical designs be better at inducing opinion change given the different topics or will one or two of the styles excel at persuasion regardless? Will the results from the previous study regarding map rankings in recall, trust, and map likability be upheld? Of particular interest is whether one rhetorical style will be preferred (or deemed most aesthetically pleasing) across the different map series. The Authoritative map was considered the best looking map in the previous nuclear study; will such a result hold up across four map series or will the argument being presented change which rhetorical style is most found most pleasing?

Limitations and Future Opportunities

Several limitations need to be addressed regarding this research project. First and foremost, a variety of factors cannot be adequately controlled for in analyzing the impact of rhetorical design on map audiences. Individual subjects will bring their own biases, beliefs, and experiences with them to the experiment. These can impact how they feel about different maps. Perhaps someone had a bad incident with an eggplant as a child, for example, and now despises the color purple. Fortunately, using large enough samples should minimize the impact of any outliers.

Context is also very important. The data being mapped and the audience to whom they are presented vary with each mapping project. These proposed studies do not attempt to address how different rhetorical styles will work, or potentially backfire, in different social and demographic contexts. Additional research will be needed to analyze these potential issues.

Finally, but perhaps most importantly, it is difficult to control for the fact that some of the maps may just be better designed than others. Though each map was created to fulfill the requisite requirements of the rhetorical categories, in-group style cohesiveness among the maps was difficult to assess. One method of limiting this shortcoming might be to have two or three designers qualitatively critique and assess the different maps and redesign them until they are deemed to be of similar design quality; this will be done with the final drafts of these maps. Also, by testing map likability across numerous data series, if one style is significantly preferred over the others regardless of the data being presented, it can be assumed that individual discrepancies in map design had little impact – as no subject will see the other designed maps of the same data.

Once we have discerned which rhetorical styles are more effective at different types of persuasive communication, it may be useful to begin doing eye-tracking studies to analyze how different rhetorical styles are actually read by map users. Eye tracking would illuminate which features of various designs are most prominently viewed, allowing us to focus on designing certain key map elements in different rhetorical contexts.

Conclusion

Maps are not only used for communicating data accurately or in a rationalist, logical form. They are rhetorical devices. As with any form of communication, the best way to determine a map's efficacy and usefulness is to test how well it makes an argument and achieves a map producer's rhetorical goals. Not only do we need to look at how well a map informs people, but in many cases, whether or not it convinces them. Do people trust the map? How memorable is a map and its argument? Do people feel an emotional connection to the message the map is trying to communicate?

It is proposed here that we begin more earnestly testing the impact that different elements of map design have on map readers personal beliefs and positions beyond merely the accuracy and amount of data they interpret. Adding to our knowledge about map design for effective rhetorical communication would not only be useful to cartographers and designers concerned with making convincing representations of truthful data, but also for communicating this data in a fashion that will be more easily recalled. Though such knowledge may be used by those with less than admirable goals (e.g., propagandists, biased news agencies, and advertisers targeting particular populations), there is ample evidence that such organizations and persons are already designing maps with these goals in mind. Adding to our knowledge in this area will shed light on how to better educate the public about reading maps critically.

Acknowledgements

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