

Going Viral: The Look of Online Persuasive Maps

Ian Muehlenhaus

Department of Geography and Earth Science / University of Wisconsin – La Crosse / WI / USA

ABSTRACT

This article explores how persuasive maps are manifesting themselves in the online world, comparing and contrasting online persuasive geocommunications with their paper map ancestors. The author discusses several social issues stemming from the widespread ability to use online mapping tools to make and distribute persuasive maps and argues that researchers have an excellent opportunity to observe the development of persuasive mapping techniques in real time as they continue to develop in conjunction with modern Web mapping technologies.

Keywords: persuasive geocommunication, persuasive maps, rhetorical maps, Web cartography, locational privacy

RÉSUMÉ

Cet article analyse la présence des cartes persuasives dans le monde en ligne et compare les géocommunications persuasives en ligne à leurs ancêtres, les cartes sur papier. L'auteur aborde plusieurs enjeux sociaux découlant de la capacité générale d'utiliser les outils cartographiques en ligne pour créer et distribuer des cartes persuasives et soutient que les chercheurs ont une excellente occasion d'observer l'élaboration de techniques de cartographie persuasive en temps réel pendant qu'elles continuent à évoluer parallèlement aux techniques modernes de cartographie sur la toile.

Mots clés : géocommunication persuasive, cartes persuasives, cartes théoriques, cartographie Web, vie privée géographique

Introduction

Web mapping has made it more feasible than ever for members of the public to collect data, design maps, and disseminate these maps to global audiences. Such developments have many benefits for the public at large, particularly regarding public participation GIS, organized resistance against corporate and government agendas, and community building. These benefits have been exhaustively reviewed in previous literature. At the same time, Web mapping technologies have also raised a host of social concerns as well. For example, a digital divide exists in nearly all societies – this divide is one of both hardware (i.e., computer access) and education (i.e., knowledge access). Concerns about spatial privacy are also abundant.

One topic concerning Web mapping that has not been given sufficient attention by scholars, however, is online persuasive maps. Persuasive maps – or maps designed to promote one viewpoint or perspective over another (Tyner 1982) – comprise a significant portion of the maps produced in societies throughout the world. Throughout modern cartographic history, technological developments

in map production have tended to make persuasive maps cheaper and easier to produce. The Internet has gone further than most previous technologies, however; not only are such maps incredibly easy to make, but the arguments one makes with these maps can be distributed virtually for free on a global scale. As numerous gun owners in a New York county recently found out, it is quite discomforting that someone you have never met can map your name and place of residence and distribute this information to the entire world to make a political statement (Haughney 2013).

In this article it is argued that we are presented with a unique opportunity to witness and simultaneously analyse, in nearly real time, how persuasive maps manifest themselves on the Web. This article starts with a brief overview of persuasive maps. This is followed by a brief discussion of the rhetorical styles found in persuasive print maps. Then, a small sample of online persuasive maps is analysed to explore in what ways online persuasive maps are similar or dissimilar to their twentieth-century ancestors. The article concludes with a call for identifying and analysing persuasive map techniques as they arise online and suggests that as such maps become ubiquitous, they need

to be studied more earnestly by geographic information scientists.

Links to all of the example maps discussed in this article, and others which were found post publication, will be made available at <http://ian.muehlenhaus.com/viral/>.

Placing Persuasive Maps within GIS

Persuasive maps are often neglected in geographic information science (GIS) literature because they do not always follow certain norms of scientific visualization (Muehlenhaus 2013a). However, since the dawn of modern thematic cartography, beginning in the late 1700s (Robinson 1982), different styles of persuasive maps have evolved in parallel to developments in academic cartography (Muehlenhaus 2011). Persuasive maps fill a different niche than scientific visualizations, but they nonetheless remain a part of GIS and are ignored at the discipline's expense.

Much has been written about persuasive maps created using the print medium. Academic interest in these types of maps took off in earnest during World War II, when both the Axis and Allied powers began using maps to try and sway their own and opposing populations to view the war in particular ways. Speier (1941) was one of the first to explore the use of maps in this fashion, warning that opposing forces might try to trick a populace with "magic cartography." It was also at this time that geographers first associated such maps with propaganda (Quam 1943). At the dawn of the Cold War, people were again warned about the dangers of "cartohypnosis" (Boggs 1947). Tyner (1982) originally coined the term "persuasive maps" in her dissertation to describe maps that are meant to convince, also including advertising maps. Others focused on government-produced maps, typically referring to them as propaganda maps (Ager 1977; Herb 1999; Monmonier and Schnell 1988; Pickles 1992). Monmonier's (1996) book, *How to Lie with Maps*, again promoted a broader view of persuasive maps beyond state-based propaganda. However, little is known about how persuasive maps manifest and are used online.

Both scientific and persuasive geovisualizations are forms of visual communication. Both of these map types can be used to explore data and draw conclusions about an environment. Both are models of reality; they posit arguments about aspects of our environment. The difference between scientific and persuasive visualizations lies in how their communication goals are achieved. The difference is in how they frame – that is, highlight and promote – their arguments.

Scientific visualizations are rationalist. Their *raison d'être* is to provide logical, scientific evidence for others to explore in search of an explanation or causation. In essence, scientific visualizations are typically exercises in bottom-up, inductive reasoning; they present a variety of facts,

often data-rich in content, and expect map readers to explore the logically presented data and draw their own conclusions, or the "truth," from what is being viewed. Scientific visualization is often veiled in the delusion of rationalist objectivity, something that is impossible via any medium of communication (Postman 2005). A multitude of facts are presented, with a heavy data-to-ink ratio ensuring that enough facts are presented to allow informed decisions (Tufte 1991). The evaluation and interpretation of the data are, theoretically, left to the discretion of the map reader. Successful scientific visualizations are not meant to persuade; they are designed to present facts in such a manner that the "truth" becomes self-evident. Even though it is questionable whether objectivity and truth are possible in any form of communication (Foucault 1986), striving for such objectivity in one's visualizations is typically considered admirable. To fail to frame data rationally is considered antithetical to good visualization.

In contrast, persuasive visualizations are created with a less limiting epistemology. Facts and truth are frequently irrelevant to the message. The goal of these types of maps is to persuade an audience to share the map creator's viewpoint about something. Thus, these maps are not always rationalist in their approach; they are more often sociopathic. When facts stand in contrast to the argument being made, persuasive maps can instead be designed as top-down rhetorical devices that target map readers' emotions, such as empathy.

Thus, not only do persuasive maps present a map user with a predetermined set of data, but, crucially, they are designed with previously established convictions about the data being represented. Again, designers of persuasive visualizations are not necessarily concerned with striving for rationalist objectivity. Instead, they implore the map user to draw certain predetermined conclusions about what is being shown. Their communication is argumentative and purposeful. They use various visual rhetorical techniques to communicate and frame arguments for map readers (as shown in Figure 1). The techniques used in persuasive visualizations vary depending on a variety of factors, including, but certainly not limited to, the nature of the intended audience, the available evidence supporting or opposing a particular viewpoint, and the desired outcome of persuasion (e.g., to cast doubt on or to raise support for or against a particular belief or viewpoint).

The techniques of persuasive visualization and those of scientific visualization are not mutually exclusive (McCoy 2000). The difference lies in the philosophy of the communication being employed: rationalist versus rhetorical arguments. When data seem to support a rhetorical argument, it may well behoove a designer of persuasive visualization to frame an argument using a rationalist approach. Indeed, it has been argued that persuasive print maps often disguise their rhetorical nature by mimicking scientific representations (Monmonier 1996). However, many



Figure 1. This is an extract of a Central Intelligence Agency (CIA) map that appeared in a report to Congress in the lead-up to the Gulf War in 2003. The map shows CIA data on weapons of mass destruction believed to be in Iraq. (You can view the original map in its entirety at <http://ian.muehlenhaus.com/viral/>.) Not only were the CIA data completely wrong, and perhaps even fabricated, but the symbology chosen for the map was also misleading. One of these violent mimetic symbols – the one that looks like an explosion – actually represents weapons that were positively destroyed by Saddam Hussein. If Congresspersons did not look closely at the map legend, they were likely to miss this important fact.

times spatial data do not support our beliefs about the world or arguments we wish to make. When this is the case, persuasive visualization typically makes use of a variety of emotional visual stimuli (Herb 1989; Pickles 1992).

Persuasive Print Map Styles

Persuasive maps take a variety of guises. They can be used to do much more than “lie” (Monmonier 1996); they are often used to reify particular beliefs and entice people into thinking about an argument from a new perspective (Wood and Fels 1992). They have evolved in parallel to the development of thematic cartography (Muehlenhaus 2011). Muehlenhaus (2010, 2012, 2013b) argues that persuasive print maps have an identifiable taxonomy. They can be broken down into four particular rhetorical and persuasive styles: sensationalist, propagandist, understated, and authoritative (Muehlenhaus 2010, 2013b).

SENSATIONALIST RHETORICAL STYLE

Sensationalist persuasive maps are those that make use of numerous graphic design elements to trigger an emotional response to spatial data. These maps are labelled as sensationalist because they bombard the map reader with a variety of superfluous graphics, text boxes, and dynamic and emotive symbolization. These maps are often data-rich, but they are not designed with clarity in mind. Instead, they are created with the purpose of overwhelming

and exciting the map reader with emotional inputs that are intended to be associated with the carefully orchestrated data being displayed. Figure 2 is an example of a sensationalist print map.

The map in Figure 2 was designed with the intention of exciting map users. It is data-rich, emphasizes dynamism with flow arrows, and uses a variety of colours, illustrations, pictures, and texture to attract and distract map users. The signs of danger, conveyed via pictures of people in radiation suits, the sarcastic title, and the flow arrows, demand attention. The multiple levels of data – including shaded relief, terraced radiation zones, urban areas outlined in red and yellow, and the unexplained inclusion of national parks – are meant to distract. Map users will have a hard time focusing on the legitimacy of the data and instead will be forced to continually refocus on a variety of visual cues imbued with persuasive intentions.

PROPAGANDIST RHETORICAL STYLE

Propagandist maps are very rhetorical in nature. They often have an assertive title. They present a single message clearly and with rhetorical aggression. They differ from sensationalist maps in that they rarely present more than two different types of data – they are data-light. Compared to sensationalist maps, propagandist maps are less likely to make use of superfluous illustrations. They often use mimetic and pictorial symbology. They are also prone to using extreme levels of contrast in colour value and hue to highlight one aspect of the data. Figure 3 is an example of a propagandist print map.

The map in Figure 3 shows little information at all. The data have been simplified to the nominal level – either you are dead or you are not. Few superfluous map elements are used; noticeably absent are data sources and a legend. The colours found on this map are high in contrast and toxic in appearance. The text used on the map is bombastic; even the text labelling safe areas contains the word *fatal*. The message is simple; if you live in these states, you will die. The title makes this clear. Why you will die is less obvious but is succinctly summarized in a short sentence of text in the lower left-hand corner.

UNDERSTATED RHETORICAL STYLE

Understated persuasive maps are data-light but look professional. They tend to represent only one or two levels of spatial information. Map elements are sparse, with minimal use of legends, neatlines, titles, text boxes, and other supplemental map elements. If an element does not enhance the argument in any way, it is excluded. These maps may appear rationalist and objective, but they are loaded with data-set manipulations. The information being presented has been highly filtered, tailored to present an argument in a straightforward, exceedingly deceptive manner. Figure 4 is an example of an understated persuasive print map.

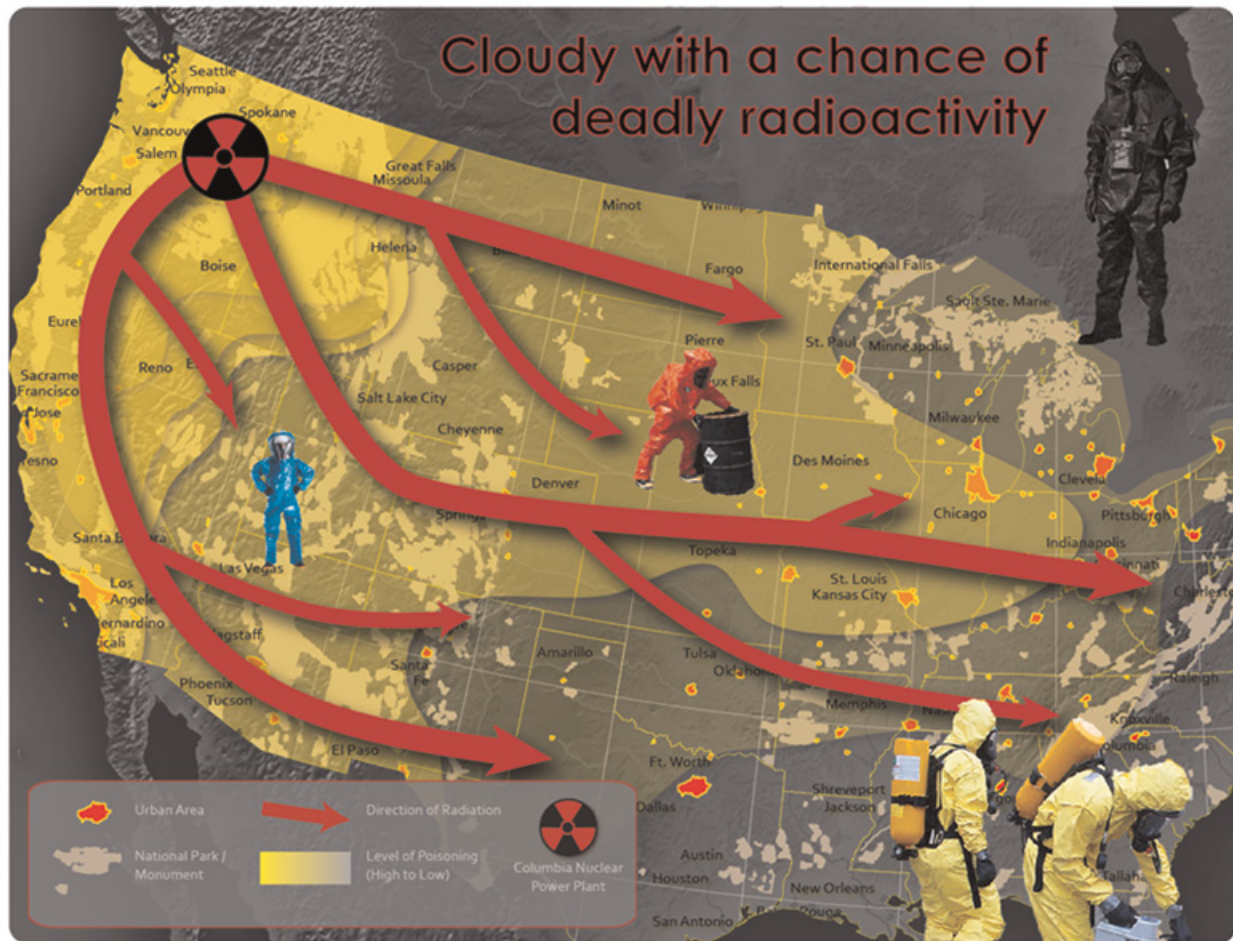


Figure 2. A sensationalist persuasive map of *fake* nuclear radiation data from a hypothetical nuclear meltdown in the United States. Originally published in Muehlenhaus 2012. © Manney Publishing; used with permission.

The map in Figure 4 is somewhat blasé. At first glance, one might not even realize it is a persuasive map. This disarming quality shows the power of understated design, which lies in its simplicity. It purposefully omits data sources. It provides merely an outline of the United States with simple isolines that are fairly easy to read. A simple legend in layperson English explains how dangerous the different levels of radiation are. It does not seem to take a stand, one way or the other, as to whether this is bad or good. Its title is neutral. And it has very little supplemental information to distract or attract a map user's attention.

AUTHORITATIVE RHETORICAL STYLE

Authoritative persuasive maps use a rationalist visualization to make a rhetorical argument. These maps often look like well-designed maps adhering to rigorous academic norms. However, a series of data-model and graphic manipulations have been used to forge an argument and present one way of seeing the world over others. Figure 5 is an example of an authoritative persuasive print map.

Authoritative maps tend to use a more rationalist visualization method. This map, for example, hides its persuasive intent behind the appearance of objectivity and accuracy. It has numerous layers of data, including populated places, making it data-rich with a high data-to-ink ratio. It has several legends and uses fake data sources for legitimacy. The map does not use aggressive titling. It allows map users to look at the map and figure out what the data mean inductively.

These four rhetorical styles of persuasive maps appear to have remained fairly consistent throughout the past 200 years (Muehlenhaus 2011). Moreover, the different rhetorical styles have been used by a variety of map producers, including governments, non-profit groups, corporations, and members of the scientific community. Analysis on persuasive maps thus far, however, has primarily dealt with the print medium. Several important questions remain unasked. As modern Web mapping technologies evolve, how is persuasive mapping or, more appropriately given the context of interactive technologies, persuasive geocommunication changing? How well does the print

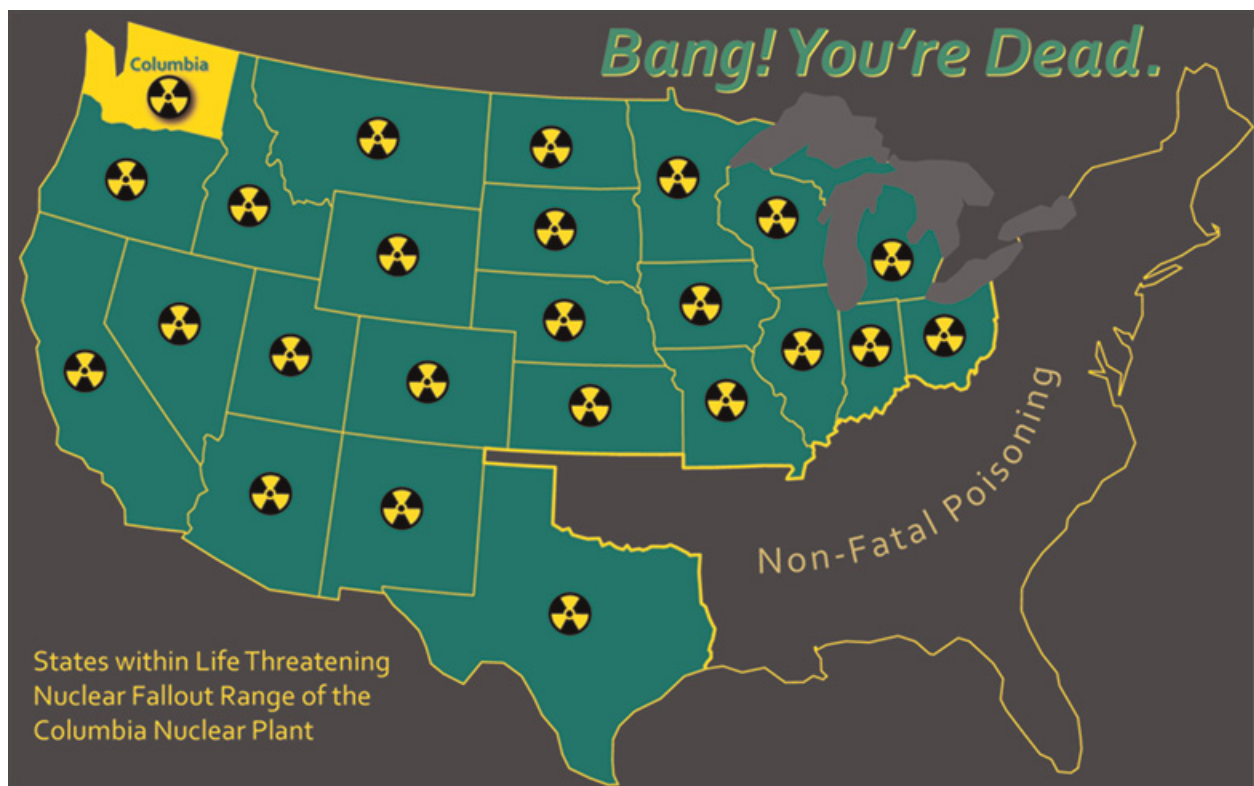


Figure 3. A propagandist persuasive map of the same *fake* nuclear radiation data from a hypothetical nuclear meltdown in the United States. Originally published in Muehlenhaus 2012. © Manney Publishing; used with permission.

taxonomy hold up in this entirely different medium? Are new forms of persuasive rhetorical styling manifesting themselves? The rest of this article differs from previous research on persuasive maps, including my own, by exploring these maps' manifestations online instead of in print.

Sampling Online Persuasive Maps

This study is exploratory in nature; a convenience search for online persuasive maps dealing with a variety of contentious topics in current events was conducted. Using the Google search engine, the author simply typed phrases such as "Obamacare," "gun rights," "Iran nuclear development," "Proposition 8," "gay marriage," "immigration," "North Korea," "Greek bailout," and the like, followed by "interactive map." To find online static persuasive maps, the same search was conducted omitting "interactive." Empirical observations were made, and numerous notes taken, about the different maps found. It became apparent early on that the types of persuasive visualizations I discovered were quite varied in nature depending on the persuasive skill level of the designer and, most important, the Web tools and mapping packages used to create them. Thus, the maps were organized into three categories based on their production characteristics. These

categories may prove ephemeral and need updating in the future, but from simple observation, online persuasive visualizations break down into three end products: (1) mashups, (2) tailored dynamic representations, and (3) static maps. The characteristics of each type of persuasive visualization design are reviewed below, along with several interesting exemplars discovered in each category.

MASHUPS

In some ways, Web technologies have made it more difficult to differentiate overtly persuasive maps from poorly designed ones. One problem is that many of the maps on the Web are produced in reverse fashion from the established cartographic design protocol. Traditionally, it is advisable for a cartographer to begin a project by analysing the spatial data he or she has and then formulate a plan for presenting those data as an objective visualization or framed argument to a particular audience. Often, though, online mapping compromises this process. Cartographers limit themselves – because of a lack of software skills or a client's desired final product – to using pre-fabricated tools for Web map design (e.g., Google Maps, Esri's ArcGIS Online). By the time data-organization and design decisions are considered, the potential efficacy of the map's communication is already grossly constrained by the limitations of the tool chosen.

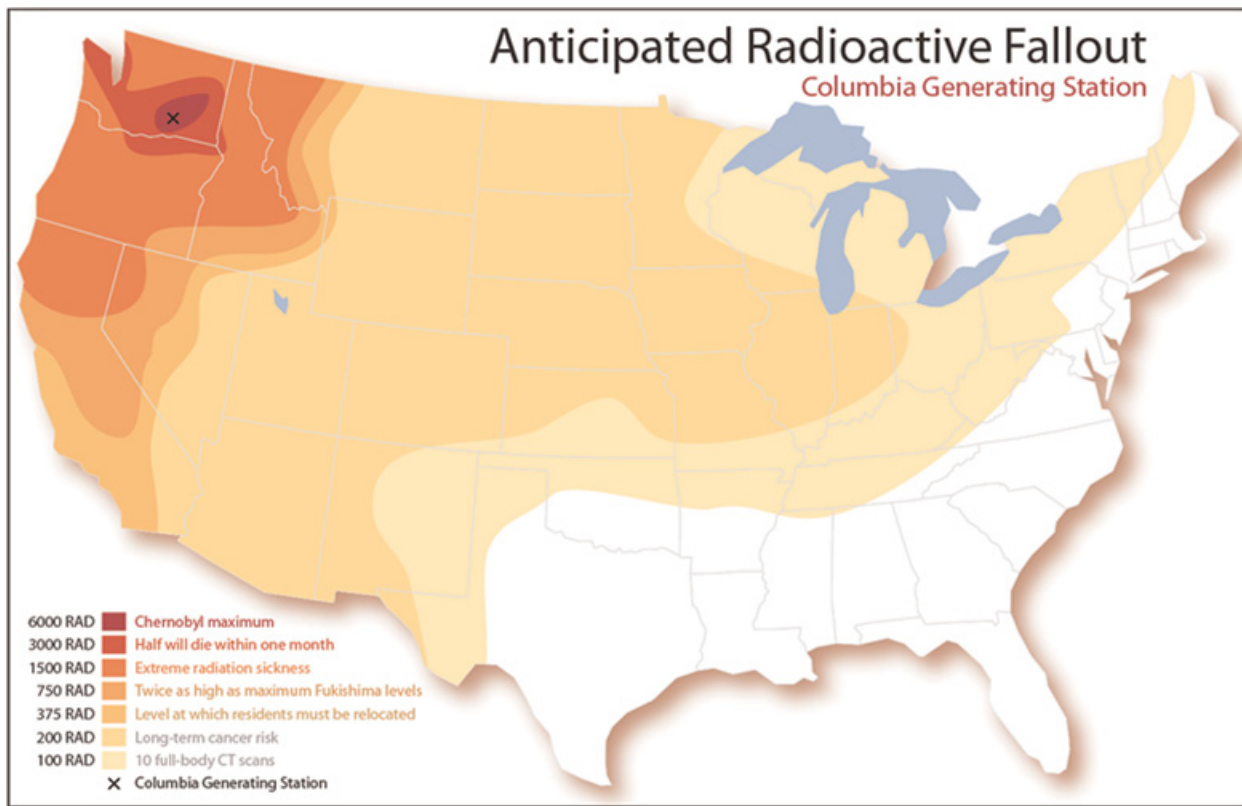


Figure 4. An understated persuasive map of the same *fake* nuclear radiation data from a hypothetical nuclear meltdown in the United States. Originally published in Muehlenhaus 2012. © Manney Publishing; used with permission.

Many Web map producers now start with the premise that they need to have an end product that looks like, or preferably is, a Google map (or, to be fair to other brands, what is commonly referred to in the industry as a “slippy map”¹). Modern map designers then try to make their data and design fit this predetermined delivery method, with mixed results, using an online mapping service such as OpenStreetMaps, Google Maps, or CartoDB. Such “mashups” almost universally use a Web Mercator projection, even if it grossly distorts and muddles the narrative being displayed (Battersby 2009). Point symbology is frequently of the generic teardrop variety (Muehlenhaus 2014), and when pictorial symbols are developed, they are often less than aesthetically pleasing (e.g., too large, pixilated, grotesquely embellished, or simplistic). When it comes to thematic mapping, mashup maps tend to be composed of Web-safe colours and frequently limit themselves to choropleth representations (see Peterson 2008a for an overview of how easy it is to create choropleth maps in this fashion). Adding cognitive injury to design insult, many of these maps display their thematic data over an eye-burning, absolutely mind-bogglingly busy and bright base map. That’s if the map reader is lucky; just as often an aerial photograph is chosen for the background by default, increasing the cognitive load on the map user and often rendering a map less intelligible (Mayer and Moreno 2003).

Of course, such examples of poor cartographic design afflict both persuasive and non-persuasive visualizations online. How can one tell whether an online visualization is using an inappropriate projection, terrifying mimetic symbols, and bright red and orange colours to be persuasive, as opposed to merely being a terrible map? There is no simple answer. The most straightforward method is to analyse the map contextually, based on its accompanying Web page or an entire Web site. If an interactive map is created by a lobby group, a political party or candidate, a company attempting to sell people things, or a non-profit organization promoting a campaign of some sort, there is a good chance it is part of a persuasive campaign.

In this study, a variety of persuasive mashups were found. These persuasive visualizations were the easiest to find. Most were created using Google Maps or Google Earth. These were also some of the most difficult maps to analyse, as they often were comprised of nothing more than generic slippy maps with varying amounts of unintuitive thematic data layered on top. Typically, these maps were embedded within a Web page. Such pages would frequently include a write-up or supplemental information and links concerning the topic being mapped. For example, the map in Figure 6 not only highlights the size of the BP oil spill in the Gulf of Mexico but includes links to compare its size to any city in the world. It also provides

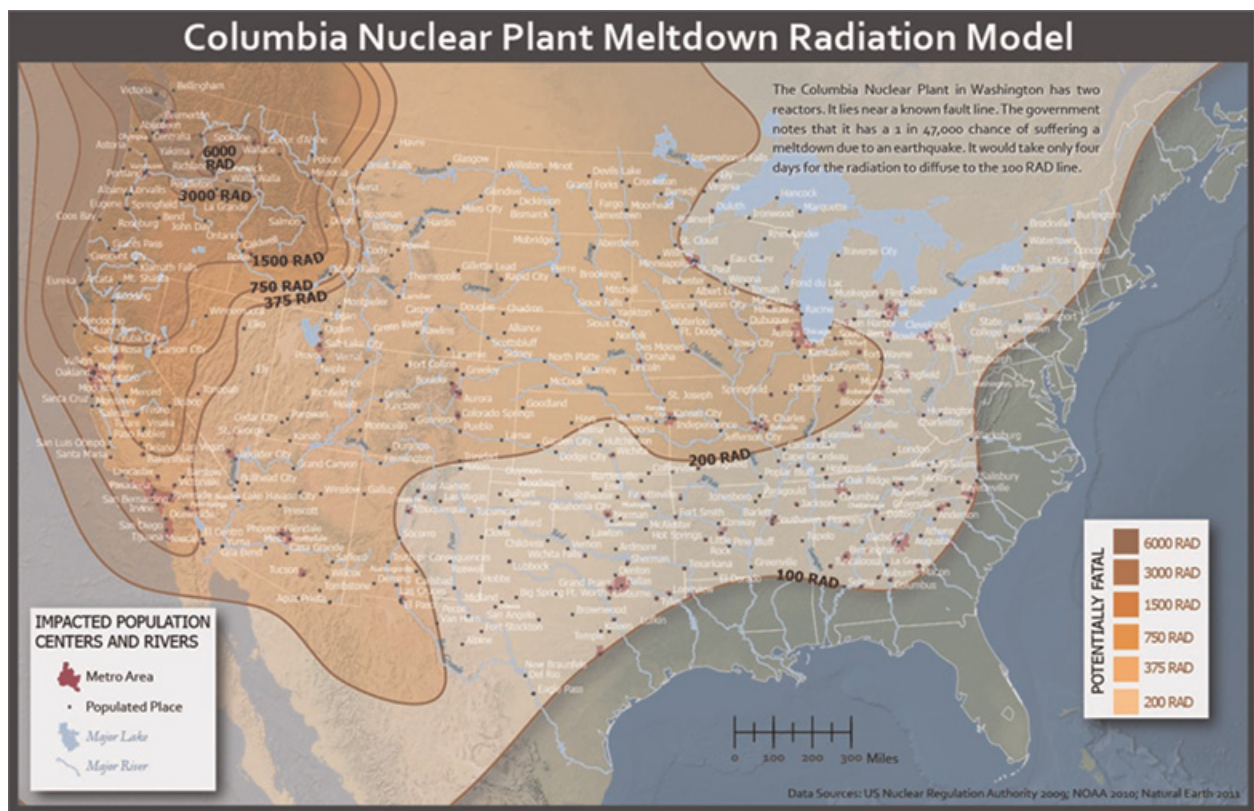


Figure 5. An authoritative persuasive map of the same *fake* nuclear radiation data from a hypothetical nuclear meltdown in the United States. Originally published in Muehlenhaus 2012. © Manney Publishing; used with permission.

resources where map readers can learn more about the magnitude and potential impact of the spill.

The benefits of using application programming interfaces (APIs)² to create online persuasive visualizations are manifold (Peterson 2012). First, online map services are cheap; in fact, unless your map receives tens of thousands of hits, they are typically free. Second, such maps are quite easy to make – if not design – and many tutorials are available online showing how to modify and personalize such maps. Third, the interface is already built into the map; the producer does not have to spend time developing a unique interface or method of delivery. Fourth, people love slippy maps, which can be panned and zoomed. Simply by using slippy maps, map designers can elicit a certain amount of excitement among map readers (Peterson 2007). An interface that allows users to have these controls and view very detailed base map information may grant such maps an aspect of authority.

However, using Google Maps or another API-based map does have some potential drawbacks (Muehlenhaus 2014). First of all, unless the map is well designed and embedded in a formal Web site, it may end up looking unprofessional – the opposite of the desired effect. Second, because of the limitations of working within the constraints of a third-party Web mapping application, the map itself

may not be that convincing. It may not frame the argument from a certain perspective clearly due to the extraneous data included in the mashup. In sum, the map creator will have less control over the rhetorical nature of the map. This is compounded by the fact that it has only recently become possible to simplify the base map using an API, and even then only if one knows JavaScript or another scripting language. There is no doubt that an effective online persuasive visualization can be designed using this software; finding such examples, however, is more difficult. Several examples, with screen captures and URL links, are discussed below.

Iran Surrounded by American Military Bases

In the years following 2010 perhaps no other international issue garnered more attention in the West than Iran and its nuclear capabilities. Hundreds of online visualizations purporting to show Iran's nuclear capabilities exist. However, persuasion is a two-way street. The map included in Figure 7 provides an alternative argument – it shows how Iran is surrounded by US military bases. It portrays Iran as confined. The title of the accompanying article on the Web page allows no doubt about the map's intended argument: "Map: US Bases Encircle Iran." Unlike most maps depicting Iran's nuclear facilities and uranium

How big is the Deepwater Horizon oil spill?

On April 20th, an [explosion](#) on the [Deepwater Horizon](#) left 17 workers injured and 11 missing and presumed dead. For over three months, oil spilled from a well 5000 feet below sea level, discharging over [500,000 gallons of crude oil](#) a day (19,000 barrels), according to the USGS. It is estimated that more than [120 million gallons of crude oil](#) have spilled into the Gulf so far.

But how big is the spill, really? It's hard to get a sense of the true size when it's over the ocean floor. Use the links below to see how large the spill is.

Compare to:

Manhattan	San Francisco
Paris	London
Rome	Hawaii
Washington, D.C.	Tokyo
Sydney	

Compare to your own city:

[Reset view](#) (Go back to Gulf Coast)

More info:

- Oil spill data courtesy of [the State of Louisiana](#), [NOAA-NESDIS](#), and Pete Giencke.
- [Photos of the oil spill](#)
- [Google Crisis Response site](#), where you can download the data shown here, to view in [Google Earth](#)

by [Paul Rademacher](#) - [femail](#)
Built using [Google Earth API](#)



Figure 6. An example of a mashup-based online persuasive visualization using the Google Earth plug-in. You can type in your home location and see how big the Gulf of Mexico oil spill was compared to where you live. Available at <http://paulrademacher.com/oilspill>. Courtesy of Paul Rademacher, www.housingmaps.com.

mines, which are loaded with fuzzy data and outright misleading information, the data on this map are not false – though they are presented with a particular rhetorical flair. This map was produced by Al-Jazeera, a news organization that plays a crucial role in shaping opinion throughout the Islamic world. The map itself is essentially a default Google Map mashup. It even uses default icons. The descriptions of military bases are technical but written from an anti-imperialist perspective. The map certainly makes it look official; Iran is surrounded. Yet the lack of design and the mechanistic styling do not make this a very emotional specimen. This map likely targets those already upset with US militarization of the Middle East. It is less likely to emotionally woo new anti-American sentiment. The map lacks emotional panache. It is probably best characterized as an understated map, even though it makes use of Google's detailed base maps. The generic interface and symbology imply a straightforward, matter-of-fact assessment, typically associated with understated persuasion.

What Health Reform Means to Your State

The Obama administration has made use of persuasive maps since before it was an administration, stretching all the way back to the 2008 primary campaign. It often uses maps to personalize the benefits of its political agenda visually. The map in Figure 8 is a prime example of this. It is purely propagandistic. It presents emotionally charged data (i.e., personal stories) in a manner that allows for only one interpretation – health-care reform is already helping

people everywhere across the United States. Data that go against this narrative are omitted, naturally. Examples are used that include all ages and races, appealing to the widest possible audience. The colours used on the map are largely bright and cheerful – primary colours. Red – the most threatening colour on the map – is reserved for small businesses. The base map is extremely simplified. (This is an example of a well-designed sloppy map, tailored for the message.) The data are simple at first but become more complex when you click on individual dots. Pop-up windows appear with embedded videos of personal testimonials and pictures of smiling, happy, presumably healthy individuals. Included with the positive images is a litany of data about how the Affordable Care Act is helping people in that particular state – displaying only numbers that support the argument and the pictures of smiling people.

Proposition 8 Donors Map

The next example is more ethically troubling than many (Figure 9). Not only is it a persuasive map in that it is directed at raising money and support for a political position, but it is also meant to target members of the opposition. This map began making the rounds via social network sites soon after the Proposition 8 referendum in California was passed. Proposition 8 was a state-wide referendum establishing a constitutional amendment banning gay marriage. Political donation records in the United States are public. So it did not take long for those opposed



Figure 7. Screen capture from Al-Jazeera Web map entitled "Map: Iran Is Surrounded." Available at <http://www.aljazeera.com/indepth/interactive/2012/04/2012417131242767298.html>. Imagery © 2014 TerraMetrics, Map data © 2014 AutoNavi, Basarsoft, Google, Mapa GISrael, ORION-ME.

to the amendment to create a map showing the geocoded locations of the amendment's financial supporters. In addition, the map provides the names of donors, their employers, and the amount of their financial contributions. This is probably best categorized as an understated map. It provides succinct information. It allows map readers to make up their own minds about the patterns being shown and decide what to do with the information. It just presents the facts. But the facts are meant to incite anger and provoke one side into action. At best, the map will convince opponents of Proposition 8 to financially support the ongoing campaign against it. At worst, it will encourage them to harass or hurt individuals with whom they disagree.

TAILORED DYNAMIC REPRESENTATIONS

Dynamic cartographic representations are proliferating on the Internet. Typically, they look like sleekly designed

traditional cartographic representations, with a unique graphical user interface. They vary in interactivity from minimal (hitting play and pause) to high (allowing for layers to be turned on and off, data to be moved around, and changes in how the symbols are represented). Many of these maps are designed with software requiring an HTML browser plug-in such as Adobe Flash, Oracle Java, or Microsoft Silverlight. The more simplistic versions of these visualizations are designed as MPEG-4 video files to simply be viewed. With the solidification of HTML5 standards, it is expected that most of these maps will start being designed using HTML, Cascading Style Sheets, and JavaScript³ in the future.

These persuasive visualizations have several advantages. First of all, the cartographer has total control over what is shown on the map. The maps are typically created from scratch. Second, the cartographer has complete control over the design of the interface and layout. Third, the types of visualizations and representations that can be

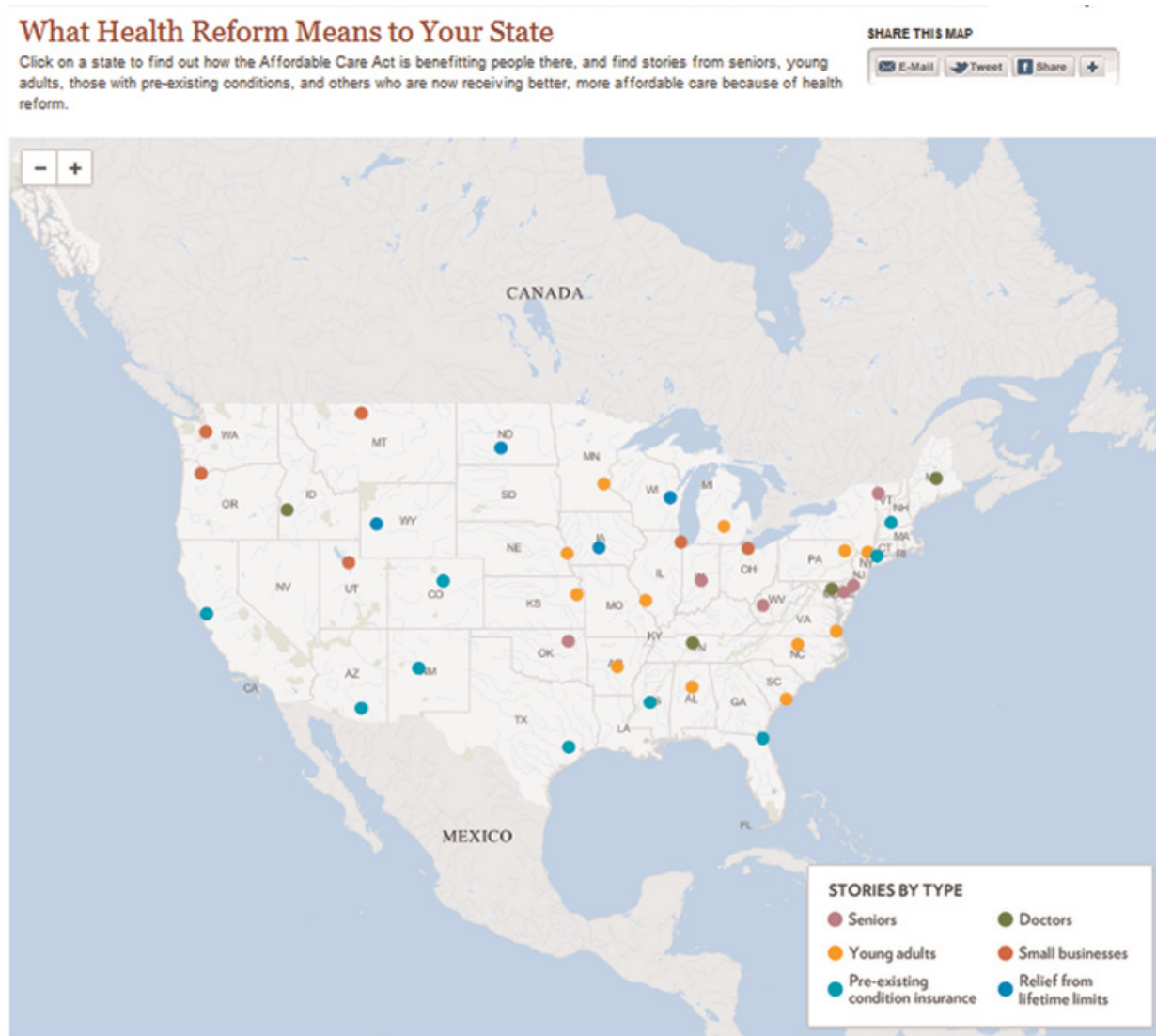


Figure 8. "What Health Reform Means to Your State." The White House Web site used an interactive Web map to help promote its controversial health-care reform initiative. Source: The White House. Available at <http://www.whitehouse.gov/healthreform/map#>.

shown are more varied and, in general, are more professional in design. These maps have a particular style and panache that the homogeneity of API maps rarely achieves. The benefits of using these types of maps for persuasion are potentially enormous. The maps can be stylized depending on one's target audience. Data can be omitted from base maps to better accentuate the intended argument and message. These maps are often developed with sexy animations – both superfluous and dramatic. Music and sounds (e.g., gunshots, explosions, screams of horror) can be added to the maps to better capture a map reader's attention and, potentially, empathy. Finally, users can be given some control over what is shown and how it is shown, helping to draw in map readers. However, although map readers may believe they have some control

over what they are viewing, the cartographer has already decided what cannot be seen or manipulated, since he or she has designed the map from scratch.

If these persuasive visualizations are potentially so effective, why are they not as ubiquitous as mashups? There are numerous drawbacks to creating such personalized visualizations. First, people are used to interacting with tiled sloppy maps. This is the norm. Thus, designing one's own interface and base maps may result in less trust among those viewing the maps. Second, such maps cannot be created as quickly as a mashup. One must spend considerable time designing, testing, and implementing a tailored dynamic map. Often this work requires a team of developers. If the project is hired out, it will cost more money and time to complete. Many online persuasive



Figure 9. A Google Maps mashup showing the names, locations, and work affiliations of donors to the Proposition 8 campaign in California, as well as the amount of money each contributed. © Google Maps. Source: www.eightmaps.com (accessed 7 June 2012).

visualizations need to be produced quickly to be effective; mashups have a distinct advantage in this regard. Finally, until recently, most of these maps have required browser plug-ins. If the goal of one's persuasive visualization is maximum map distribution – that is, a high number of views – rather than map quality, using a plug-in is probably not desirable. (Plug-ins require users to have additional applications installed to view a map file.) Three examples of such maps are discussed below.

New York City Abortion Ratio by ZIP Code

The map in Figure 10 is a stellar persuasive visualization on many levels. Its Web address, <http://www.nyc41percent.com>, actually tells you what the map is showing – New York City has a 41% abortion ratio. (Note: This is according to the producers of the map and has not been fact-checked by the author.) The map is elegantly designed with smooth animation transitions as one moves a mouse around the map. One can interact with each city ZIP code to explore how the rate varies across the city. The map presents temporal data – one can choose which year from the 2000s one would like data for, or have the map play through an animation of abortion rates. A dark red colour is used to represent the data. A simple zoom feature, which is really not necessary to view any additional information, facilitates the slick interface design and gives the map a modern feel. This map is understated. It really is just a choropleth map of ratio data. However, the message is difficult to miss and is subtly reinforced by

how the data are defined and presented – the abortion rate in New York City is high.

A Nation Divided over Immigration

The second example is also an understated map (see Figure 11); many of the tailored dynamic representations were of this type. This map is a thinly veiled attack on Arizona state legislation concerning immigrant rights in the United States. Above the map on the Web site, a reader has three hyperlink options to choose from – *A Nation in Chaos*, *A Nation Divided*, or *A Nation United*. The ordinal categories comprising the map appear to be completely subjective, and they have somewhat stark descriptions. When one clicks on *A Nation Divided*, a map is shown that does not change too much from the original – strict anti-immigrant laws will remain in effect. Then, when a user clicks on *A Nation United*, the entire map goes grey. A short subtitle notes that this is what will happen if the Supreme Court overturns the Arizona law – the country will be united without Arizona-style legislation. This map is not comprised of sexy graphics or the like. It has very limited HTML interactivity. It communicates its argument succinctly and matter-of-factly.

A Map of Israeli Security

The most exciting map found in this convenience sample was also one of the most difficult to categorize (see Figure 12). The map is a video animation highlighting the

NEW YORK CITY ABORTION RATIO BY ZIP CODE

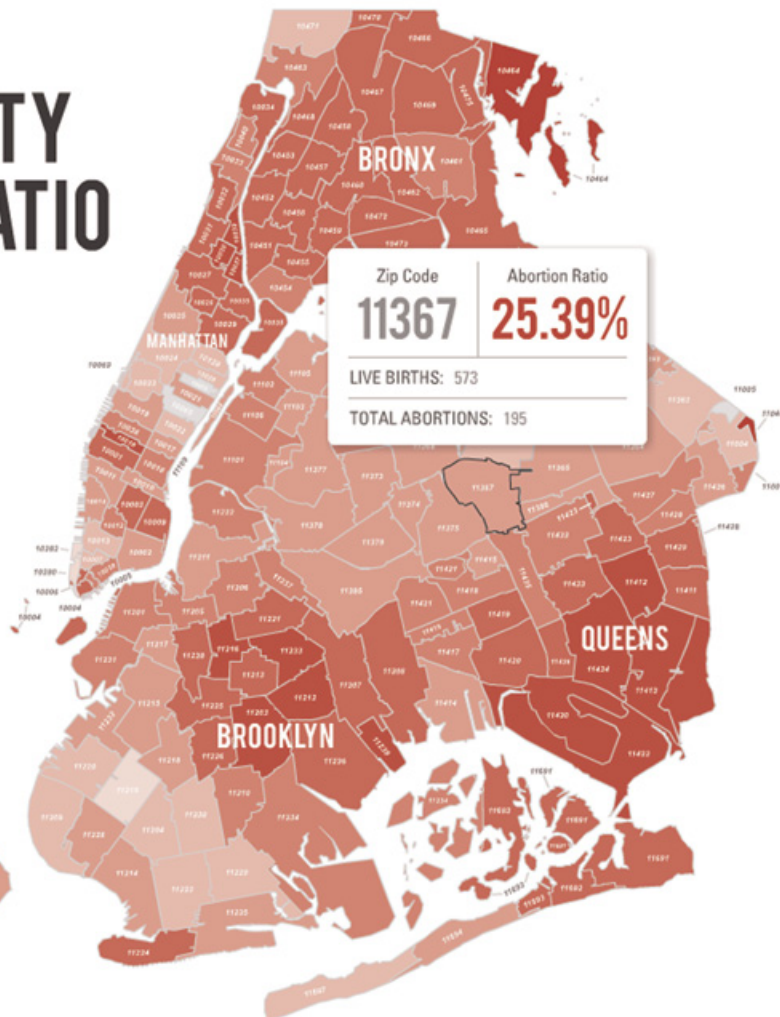
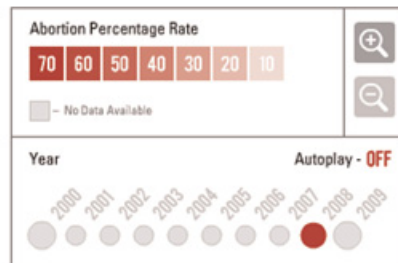


Figure 10. New York City's abortion ratio by ZIP code. Screen capture shows the rate for an individual ZIP code within the city. Available at <http://www.nyc41percent.com>. Courtesy of the Chiaroscuro Foundation.

dangers that a Hamas-controlled Gaza Strip presents to the Israeli state. The map was created by the Israeli Defence Forces – that is, Israel's military. It is currently available both on their blog and on YouTube (see caption for details). Titled “What Gives Israel the Right to Defend Itself?,” it presents an incredibly straightforward and quite simplistic animated map showing how dangerous the Gaza Strip is to Israeli sovereignty. It then notes that Israel has not only a right but an obligation to protect its citizens. It ends with an incredibly propagandistic enticement – “For More Information, Click the Link Below” – which takes users to an entire Web page devoted to the same argument presented in the map.

This map is meant to dynamically bolster the argument that Israel is under siege. I recommend that readers view this map in its entirety for an example of an online sensationalist geovisualization. There is narration; there is ominous music in the background; there are flow lines with arrows, rockets, and little innocent houses being attacked. Numerous arguments for Israel's right to defend itself –

that is, to counter-attack – are made while the map reader is subjected to a dynamic and exciting presentation of the dangers Israel must confront on a daily basis.

This is an example of an expensive, high-end, military-backed cartographic production that harks back to similar maps in 1930s Germany (see, for example, Herb 1989, 1999). What it lacks in interactivity it more than makes up for in dynamism and superfluous graphic representation. This map takes the form of a video but is still very much a sensationalist map. It overwhelms the map viewer with information and visual stimuli over the course of 39 seconds. It is difficult not to empathize with a country that is, according to the map producer, being barraged with missiles. Of course, this persuasive map omits data on the excessive force potentially used by the Israeli Defence Forces in their counter-attacks on the Gaza Strip as well as information on the illegality of Israeli settlements in the West Bank under international law – a situation that partially fuels distaste for the Israeli state on the part of Palestinians in Gaza as well.

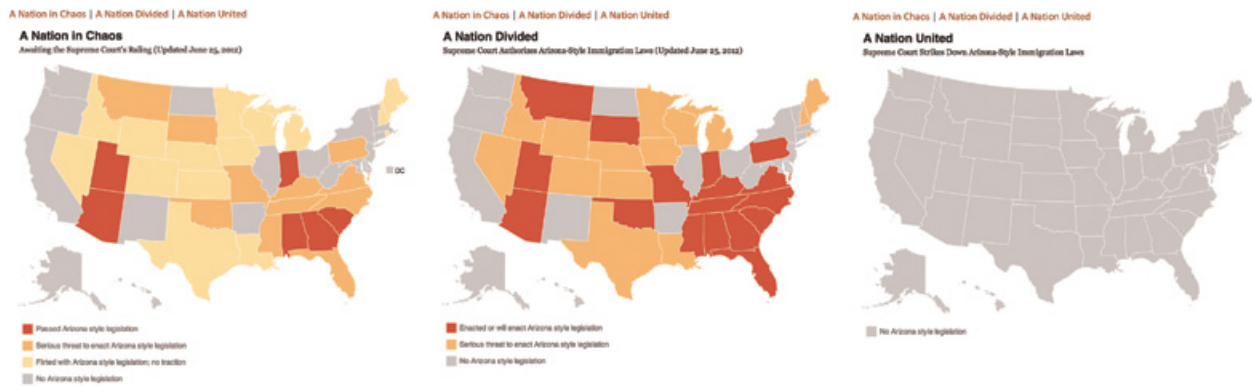


Figure 11. Immigration policy map. Maps available at http://www.americanprogress.org/issues/2012/04/immigration_map.html. Courtesy of American Progress.



Figure 12. Israeli Defence Forces animated map: "What Gives Israel the Right to Defend Itself?" Source: Israeli Defence Forces. Available at <http://www.idfblog.com/2012/11/15/what-gives-israel-the-right-to-defend-itself/>. © 2012 Israel Defense Forces, CC BY-SA 2.0.



Figure 13. A version of the Jesusland meme that circulated widely on the Internet, re-created by author. Source: By Liftarn, GFDL or CC BY-SA 3.0 via Wikimedia Commons.

STATIC MAPS

The last category of online persuasive visualization is static maps. Although less technologically savvy than the previously discussed map types, in this exploratory survey static maps were nonetheless some of the most aesthetically appealing and ubiquitous. Most of these are produced using standard GIS, graphic design, or rudimentary drawing techniques. They are found online in a variety of formats (e.g., PNG, GIF, JPEG, PDF).

The benefit of keeping one's persuasive visualizations simple is obvious. Any browser can open an image file. Moreover, these maps are easily distributed via e-mail as attachments or through social networking and photo

sharing sites. Persuasive arguments are not only framed but also sculpted in static maps; without interaction, it will be difficult for the reader to miss the intended message. Another advantage of static maps is that they can easily be printed. Finally, a well-designed static map has the potential to become an Internet sensation (i.e., meme).

Jesusland

An example of this potential is found in the now infamous Jesusland map from 2004 (see Figure 13). The original version of this map was created by G. Webb the day after John Kerry lost his election bid against President George W. Bush. The *New York Times Magazine* referred to this map as "an instant Internet classic" (Hitt 2004).

The map was originally shared within a relatively small online social circle (at yakyak.org); the simple map resonated so strongly with elements of the public, though, that this map became a meme among the Left in the United States.

Of course, there are drawbacks to using a simple static representation as well. First, it has the potential to simply be overlooked. Interactivity is very attractive to Internet users. Embedded in the middle of a Web page, a static map's inability to catch a reader's attention may defeat the purpose of creating the map in the first place. The lack of interactivity might benefit communication of the message (something that needs exploration), but a map reader is likely to be less engaged with a static map than with an interactive map. Another drawback of static maps on the Web compared to printed maps is resolution. The amount of aesthetic detail that can be conveyed via standard monitors and high-definition screens is still limited.

Static online maps are not necessarily merely embedded as a graphic, however. Indeed, this author found several novel ways used to draw map readers into a site and get them involved in reading, and even creating, the rhetoric on a persuasive map. The most egregious example of this is reviewed below.

What If Hamas Was in Your Neighbourhood?

The term "propagandist" may not do this map justice (see <http://ian.muehlenhaus.com/viral/>). The Anti-Defamation League came out with this cartographic campaign approximately five years ago. Using a simple Web interface, visitors could pick their US city from a list and print out maps to distribute of their city being bombed by rockets from the Gaza Strip. Several things about this series of static maps are absolutely fascinating. First of all, the Anti-Defamation League figured out how to make static maps interactive by having users comb through propaganda material and then choose their own home city to be bombed. Second, the maps are personalized to an extreme. Through a map of the range of Hamas rockets over Des Moines, Iowa, for example, the conflict between the Israeli Defence Forces and Hamas is literally brought home for many map readers. It is bound to garner empathy among those who do not have an inherently pro- or anti-Israeli foreign policy opinion. Third, certain cities were not included in the list. Des Moines is an option but not Minneapolis – a much larger metropolitan area. It is hard to know why this was done for certain, but one might suppose that, in reality, Hamas rockets do not have much range. Thus, they might not hit Minneapolis from its own suburbs. Finally, the most deceitful aspect of the argument being made with these maps is that the areas being targeted by Hamas in Israel do not have particularly dense populations. Placing Gaza adjacent to major US metropolitan areas housing millions of people

is not at all comparable to its real location next to the Negev Desert. This is certainly an exemplary online persuasive visualization.

The State of Online Persuasive Map Design

The preceding categorization and analysis of online persuasive maps leads to more questions than it answers. A brief overview of the evidence found in this sample is in order. The analysis will be broken down into a series of questions. First, to what extent do online persuasive maps parallel the rhetorical nature of static ones as outlined by Muehlenhaus (2010, 2013b)? How are they similar? How are they different? Second, what are the potential benefits and drawbacks of the different styles and mediums of online persuasive maps? Finally, were there any observable patterns regarding what types of organizations are using maps as rhetorical tools to make arguments, and, if so, were there any repetitive techniques or styles?

SIMILARITIES AND DIFFERENCES FROM PRINT MAPS

Online persuasive visualizations appear to still be in an embryonic stage of development. The vast majority of the maps found in this analysis were simplistic and less than aesthetically pleasing compared to what a search for their printed counterparts might find. Those that do exist tend to camouflage themselves as standard visualizations – authoritative rhetoric – quite well by using a standardized API.

Online persuasive visualizations may not be as comprehensively developed as print ones simply because of the changing nature of both mapping and society. As maps have become easier and cheaper to create, and the server space where they are stored is easily appropriated for other data, their longitudinal value is diminished. We live in a data-driven society with 24-hour news cycles. Maps of any variety simply have less staying power online; the stories they tell and the arguments they make are fleeting and rapidly forgotten.

Some have argued that map design for the Web has suffered because of this (Peterson 2008b). This author concurs. However, the decline of design in GIS does not mean that aesthetically pleasing maps are no longer appreciated. Rather, design is disappearing because there is a diminishing return on the time spent on the aesthetics of Web maps. Playdough is a great building medium; it is even slippy in a sense! One could build elegant and marvellous things out of it. One rarely does, however, because the medium is designed to be ephemeral. The designs are eventually discarded. The same might be said for Web content in general.

With regard to Muehlenhaus's (2010, 2013b) taxonomy, mentioned above, the styles continue to exist but do not appear to be as strongly delineated as they were in the

print sample. That taxonomy likely needs to be modified for persuasive Web visualizations, as it cannot adequately account for the ubiquitous use of satellite imagery and extremely detailed base maps found in many APIs. In print, most of these highly detailed maps would probably fall into the authoritative category, as until recently aerial photos and detailed base maps were expensive to produce or purchase the rights to. Therefore, persuasive print visualizations that used such techniques were often produced by governments or wealthy publishers. These days, maps using aerial photography are some of the easiest and cheapest to produce online. The authoritative novelty of such data has been delegitimized through their ubiquity.

Understated persuasive visualizations are proliferating on the Web. Most dynamic cartographic representations viewed in this study fell into the understated category. There are a variety of reasons that non-API-based interactive maps are more likely to be understated than authoritative, sensationalist, or propagandist. First, many professional cartographers, who are bona fide information architects, believe in the power of abstraction. Less can be more; it can help the map reader interpret things clearly. Given that those with enough training to design their own dynamic cartographic persuasive representations are likely professional designers, it makes sense that they would simplify their maps to communicate and persuade more effectively. Even among the understated maps that were data-rich, users typically had the ability to turn layers of data on and off. The maps often had intuitive, personalized interfaces. Finally, the maps rarely started with all of the data shown concurrently, as is often the default with API mashups.

Sensationalist and propagandist maps were primarily found online as static representations, likely produced for maximum distribution on the Web. Several animated maps fit these specifications, but these were not necessarily interactive – just elaborate movie clips with play and pause options. Many of the propagandist persuasive visualizations were designed for print; the Web appears merely to be a tool for their rapid and widespread distribution.

BENEFITS AND DRAWBACKS OF DIFFERENT ONLINE PERSUASIVE VISUALIZATION DESIGNS

As already outlined, there are likely benefits and drawbacks to the three different compositions of online persuasive visualizations reviewed here. First, API mashups are a relatively easy way to create maps that reach a broad audience, do not require browser plug-ins, and can be updated easily. Personalized, interactive online persuasive visualizations are potentially more emotionally powerful and aesthetically pleasing – although studies have yet to confirm this – but are far more likely to be expensive, difficult, and time-consuming to produce. Static persuasive

visualizations are used for a variety of reasons. Probably the main benefit of a static image is that it is a tested and proven medium of persuasion. The effects of static graphics on human empathy are well established in graphic design literature (Buchanan 1985). Also, static maps may have more potential for dissemination, as they do not require a URL link but can be attached to e-mails, posted on social networks, and more. This distribution advantage is likely to diminish in the near future, however, as HTML5 standards progress and begin to further incorporate video embedding (Vaughan-Nichols 2010).

TELLTALE DESIGN PATTERNS

This study was not broad enough to earnestly draw any conclusions about patterns and styles of online persuasive maps. However, a couple of techniques did seem to be proliferating. Pictorial point symbols were very common on maps in this sample. When it came to thematic representation of areal features, choropleth and proportional symbol representations were used most frequently. Before the study began, the author opined that animated flow maps would be an effective and dynamic method to use in certain persuasive circumstances. Only a few such visualizations were found, however.

In this exploratory study, the only correlation between the map producer and the type of persuasive Web map produced was that institutional producers tended to make more aesthetically pleasing maps. Citizens' groups and less well-funded or tech-savvy map producers were more likely to use out-of-the-box slippery maps. It is too early to argue that a digital divide among persuasive map-makers exists, but it certainly appears this could be a possibility.

Conclusion

This article has explored the nature of online persuasive visualizations. Like their counterparts in print, these come in many guises. By organizing these maps into groups based on the nature of their production, qualitative analysis of their styles is possible. Moreover, they can be compared and contrasted to their ancestors in print. Obviously, the Web medium allows for these types of maps to have far more features than they would if they were only in paper form. However, it is still unclear whether the art of framing an argument, or of controlling how a debate is contextualized, achieves any particular advantage through interactivity.

What has become evident in this research is that persuasive maps have moved online. Although still relatively simplistic in their design compared to what has been done with print persuasive maps, it can only be hypothesized that certain producers will hone their skills and that more producers of such maps are sure to come, as Web map production and design become more accessible to

the masses. Static maps created for distribution online may have even more power than interactive ones, as they turn into Internet memes (e.g., the Jesusland map in Figure 13).

This article was but a first expedition into the world of online persuasive maps. It was extremely limited in scope. The analysis was descriptive and based on a convenience sample. Only English phrases were used to search for these maps. Certainly, more advanced online persuasive maps exist of which the author is unaware. Likewise, thousands of even less effective ones surely can be found. This article in no way pretends to be holistic or authoritative. With these limitations out in the open, there are several key takeaway points.

First, these maps are already quite abundant and are almost certainly going to increase in the future. It will be to GIS's advantage to begin seriously identifying and analysing these types of maps earlier rather than later. This author believes that researchers are being afforded a wonderful opportunity to pre-emptively prepare for and analyse the development of a particular genre of maps in real time, as the maps evolve and grow more abundant. It would be a mistake to merely dismiss these as irrelevant anomalies that are not of interest to GIS professionals, as has largely been done with persuasive maps in the print medium. Some of the most beautiful and convincing maps in the history of print cartography have been persuasive ones. Surely there will be something to learn about design and visual rhetoric from their online counterparts.

Second, it becomes even more imperative (than it already was) to start educating the public now about the drawbacks of reading maps uncritically. The shift from Web 1.0 to Web 2.0 has made maps easy to distribute, share, and promote. The move of GIS from desktop applications to cloud services will indubitably make collecting and manipulating spatial data for persuasive purposes easier than ever. With both the altruistic and capitalistic benefits of "GIS for everyone" come other social ramifications. A startlingly large number of people already trust their GPS devices ... even to the point of death (see, for example, Tremlett 2010). People's mental maps of the world are already being distorted by the ubiquitous use of global projections, most notably the Web Mercator (Roberts and others 1995). Without proper education and instruction, a large part of the public outside of academia will be susceptible to simply believing what they see in a given online persuasive visualization.

Third, because of their potential for interactivity, online persuasive maps will offer new techniques of rhetorical communication that print maps could not. Many of the techniques embraced by print maps, however, will likely remain powerful rhetorical devices on the Web. Of the maps in this sample, the most overtly persuasive ones still used established static techniques of manipulation to make their arguments. Many of the maps reviewed for this study were completely or mostly static in nature.

In fact, a question that might be addressed in future research is whether interactivity is even beneficial for communicating an argument. It is well established that interactivity can benefit map readers who are using maps to complete specific tasks and researchers who are using maps for exploratory visualization. However, if framing an argument is one's primary goal, less user interactivity may be more effective, as it conceivably would allow the producer to control information and hone the arguments more effectively. Perhaps we still see so many static persuasive maps online because user interactivity may actually reduce the map reader's ability to focus on the rhetorical message itself. It may be no accident these maps lack interactivity; it very well could be a deliberate attribute of their design.

Conversely, persuasion is not just about communication; it also depends on perception. More research might be done on differences in trust among these different types of online visualizations. For example, perhaps people trust static maps less than interactive maps. Even with interactivity, it would be interesting to begin investigating whether map readers trust tailored dynamic representations more or less than tile-based slippy maps. These are only several of the many avenues for future research concerning the dawn of online persuasive visualizations.

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Author Information

Ian Muehlenhaus holds a PhD in Geography from the University of Minnesota and an MSc from Penn State. His research interests include map rhetoric, persuasive mapping, and Web map design. In addition to a handful of journal articles, he is the author of the book *Web Cartography: Map Design for Interactive and Mobile Devices*. He currently teaches map design, Web mapping, and human geography courses at the University of Wisconsin – La Crosse. He can be contacted at www.ian.muehlenhaus.com.

Notes

1. "Slippy map" is the term used by cartographic professionals and Web developers to describe Web-based maps that allow a map user to pan and zoom with an interface tool such as a mouse or touch screen. These maps are typically comprised of numerous map tiles.

2. APIs are created and distributed by the creators of map services and data. An API is a collection of scripts and codes that Web map-makers can use to interact with, make use of, and manipulate map services and map data. For example, the Google Maps JavaScript API allows a Web map-maker to use Google Maps tiles underneath his or her own data. The tiles can also be manipulated – labels removed, base map colours changed – and map elements can be altered.
3. JavaScript is *not* Java. JavaScript is a scripting language used to provide native interactivity on Web pages. It is easily interpreted by nearly all Web browsers and therefore is considered a core HTML5 technology, along with HTML and Cascading Style Sheets. Oracle's Java, on the other hand, is used to create many stand-alone applications and can be run in most Web browsers only via a plug-in.

References

- Ager, J. 1977. "Maps and Propaganda." *Bulletin of the Society of University Cartographers* 11(1): 4–14.
- Battersby, S.E. 2009. "The Effect of Global-Scale Map-Projection Knowledge on Perceived Land Area." *Cartographica* 44(1): 33–44. <http://dx.doi.org/10.3138/carto.44.1.33>
- Boggs, S.W. 1947. "Cartohypnosis." *Scientific Monthly* 64(6): 469–76.
- Buchanan, R. 1985. "Declaration by Design: Rhetoric, Argument, and Demonstration in Design Practice." *Design Issues* 2(1): 4–22. <http://dx.doi.org/10.2307/1511524>
- Foucault, M. 1986. "Truth and Power." In *The Foucault Reader*, ed. P. Rabinow, 51–75. London: Penguin.
- Haughney, C. 2013. "After Pinpointing Gun Owners, Paper Is a Target." *New York Times*, 7 January. Available at <http://www.nytimes.com/2013/01/07/nyregion/after-pinpointing-gun-owners-journal-news-is-a-target.html?pagewanted=all>
- Herb, G. 1989. "Persuasive Cartography in Geopolitik and National Socialism." *Political Geography Quarterly* 8(3): 289–303. [http://dx.doi.org/10.1016/0260-9827\(89\)90043-8](http://dx.doi.org/10.1016/0260-9827(89)90043-8)
- Herb, G. 1999. "Before the Nazis: Maps as Weapons in German Nationalist Propaganda." *Mercator's World* 4(3): 26–31.
- Hitt, J. 2004. "Neo-Secessionism." *New York Times Magazine*, 12 December. Available at http://www.nytimes.com/2004/12/12/magazine/12NEO.html?_r=1
- Mayer, R.E., and R. Moreno. 2003. "Nine Ways to Reduce Cognitive Load in Multimedia Learning." *Educational Psychologist* 38(1): 43–52. http://dx.doi.org/10.1207/S15326985EP3801_6
- McCoy, K. 2000. "Information and Persuasion: Rivals or Partners?" *Design Issues* 16(3): 80–83. <http://dx.doi.org/10.1162/07479360052053342>
- Monmonier, M.S. 1996. *How to Lie with Maps*, 2nd ed. Chicago: University of Chicago Press. <http://dx.doi.org/10.7208/chicago/9780226029009.001.0001>
- Monmonier, M.S., and G.A. Schnell. 1988. "Political Maps." In *Map Appreciation*, 201–46. Englewood Cliffs, NJ: Prentice-Hall.
- Muehlenhaus, I. 2010. "Lost in Visualization: Using Quantitative Content Analysis to Identify, Measure, and Categorize Political Cartographic Manipulations." PhD diss., University of Minnesota.
- Muehlenhaus, I. 2011. "Genealogy That Counts: Using Content Analysis to Explore the Evolution of Persuasive Cartography." *Cartographica* 46(1): 28–40. <http://dx.doi.org/10.3138/carto.46.1.28>
- Muehlenhaus, I. 2012. "If Looks Could Kill: The Impact of Different Rhetorical Styles on Persuasive Geocommunication." *Cartographic Journal* 49(4): 361–75. <http://dx.doi.org/10.1179/1743277412Y.00000000032>
- Muehlenhaus, I. 2013a. "The Design and Composition of Persuasive Maps." *Cartography and Geographic Information Science* 40(5): 401–14. <http://dx.doi.org/10.1080/15230406.2013.783450>
- Muehlenhaus, I. 2013b. "Four Rhetorical Styles of Persuasive Geocommunication: An Initial Taxonomy." In *Proceedings of the International Cartographic Conference*, Dresden, Germany.
- Muehlenhaus, I. 2014. *Web Cartography: Map Design for Interactive and Mobile Devices*. Boca Raton, FL: CRC Press.
- Peterson, M. 2007. "Elements of Multimedia Cartography." In *Multimedia Cartography*, 2nd ed., ed. W. Cartwright, M.P. Peterson, and G. Gartner, 63–73. Berlin: Springer. http://dx.doi.org/10.1007/978-3-540-36651-5_5
- Peterson, M. 2008a. "Choropleth Google Maps." *Cartographic Perspectives* 60: 80–83.
- Peterson, M. 2008b. "Maps and the Internet: What a Mess It Is and How to Fix It." *Cartographic Perspectives* 59: 4–11.
- Peterson, M., ed. 2012. *Online Maps with APIs and WebServices*. Berlin: Springer. <http://dx.doi.org/10.1007/978-3-642-27485-5>
- Pickles, J. 1992. "Text, Hermeneutics and Propaganda Maps." In *Writing Worlds: Discourse, Text, and Metaphor in the Representation of Landscape*, ed. T.J. Barnes and J.S. Duncan, 193–230. New York: Routledge.
- Postman, N. 2005. *Amusing Ourselves to Death*, rev. ed. New York: Penguin.
- Quam, L.O. 1943. "The Use of Maps in Propaganda." *Journal of Geography* 42(1): 21–32. <http://dx.doi.org/10.1080/00221344308986602>
- Roberts, S.M., R.H. Schein, M. Dear, D. Gregory, and N. Thrift. 1995. "Earth Shattering: Global Imagery and GIS." In *Ground Truth*, ed. J. Pickles, 171–95. New York: Guilford.
- Robinson, A.H. 1982. *Early Thematic Mapping in the History of Cartography*. Chicago: University of Chicago Press.
- Speier, H. 1941. "Magic Cartography." *Social Research* 8(3): 310–30.
- Tremlett, G. 2010. "GPS Directs Driver to Death in Spain's Largest Reservoir." *The Guardian*, 4 October. Available at <http://www.guardian.co.uk/world/2010/oct/04/gps-driver-death-spanish-reservoir>
- Tufte, E.R. 1991. *Envisioning Information*. Cheshire, CT: Graphics Press.
- Tyner, J. 1982. "Persuasive Cartography." *Journal of Geography* 81(4): 140–44. <http://dx.doi.org/10.1080/00221348208980868>
- Vaughan-Nichols, S.J. 2010. "Will HTML 5 Restandardize the Web?" *Computer* 43(4): 13–15. <http://dx.doi.org/10.1109/MC.2010.119>
- Wood, D., and J. Fels. 1992. *The Power of Maps*. New York: Guilford.

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