The Design and Composition of Persuasive Maps

Abstract

Persuasive maps are ubiquitous in society, yet cartographers have largely neglected to conduct serious, holistic research on them. Persuasive maps represent a form of visual communication that differs markedly from scientific geovisualization. First, many of these maps’ communicative goals are anathema to those of scientific representation. Second, many persuasive maps ignore and defy established cartographic conventions. This article argues two things. First, the cartographic discipline can gain insight about how maps communicate information from the longitudinal and holistic analysis of persuasive maps. By comparing the differences and similarities of persuasive maps to scientific geovisualizations, researchers can begin to understand how persuasive maps communicate differently than scientific ones. Second, breaking persuasive maps down into composite parts may make it possible to identify persuasive map norms (i.e., methods of design that are embraced by producers of persuasive maps). The results of a content analysis of 256 persuasive maps are discussed. The paper concludes that it may be possible to take the most statistically significant results from this study to begin identifying different rhetorical styles of persuasive maps.

Keywords

persuasive maps, rhetorical maps, content analysis, map design
Introduction

Cartographers have treated persuasive maps like unwanted step-children. Maps that have been created “with the purpose of eliciting one particular interpretation over others from map readers” (Tyner, 1982: 140, paraphrased), instead of explaining or providing data for clarity, are often ignored and ridiculed in academic circles as superfluous cartographic anomalies. Such visualizations are often only shown to students when a lecturer is expounding upon “what not to do” in map design. It is the argument of this author that such cartographic chauvinism is a disciplinary ailment that needs remedy.

The rationale behind the forthcoming article is that persuasive maps are neither superfluous nor anomalies. They are as much a part of the cartographic discipline as persuasive writing is to linguistics. In many cases they are seen and recalled by more people than scientific-looking maps are – found in advertisements, political propaganda, tourism brochures, and in a wide variety of literature. The reason academic cartographers have had such a difficult time dealing with these maps is because they cannot be understood, explained, or effectively analyzed solely using the established norms of academic cartography. If we start with the presupposition that all maps are a form of communication, many academic critiques of persuasive maps are downright biased. For, just as an English professor cannot justly critique the use of double-negatives in the Hungarian language based on the rules of English grammar, neither is it appropriate for geovisualization experts, or “information architects,” to judge the efficacy and merits of persuasive maps based solely on the norms of scientific visualization (i.e., clarity and accuracy).

This article does two things. First, it makes an argument that academic cartographers need to start rigorously exploring how persuasive maps construct and articulate their messages in different contexts. Communications being presented with persuasive maps are typically designed differently than they would be as scientific visualizations (or what I hereon refer to as scientific maps), but this does not make one form of communication better than the other.
Before we can begin understanding and interpreting persuasive maps, we need to figure out how they are constructed. We need to figure out the nature of persuasive maps’ visual grammar. Due to the fact that regardless of their type, maps attempt to communicate information about our spatial environment, some of the grammatical rules of persuasive maps will be very similar to those of scientific mapmaking; other rules, however, will differ markedly.

In that vein, the second part of this article presents the results of an attempt to deconstruct persuasive maps into composite parts and analyze how these parts correlate with one another. This study represents a preliminary, introductory attempt to decipher the inner machinations of persuasive maps and begin exploring the composition, or grammar, of persuasive map communication. The goal is to see if any patterns emerge that can help us better understand these cartographic specimens based off of their own history of composition and fuel more beneficial research of these maps in the future. This is a first attempt to begin creating a Rosetta Stone of persuasive maps, to test which contemporary beliefs about persuasive maps are true and which are likely erroneous. Once any key or distinct design elements found in persuasive maps are identified, in-depth research on their rhetorical nature can be conducted.

**Literature Review**

As communicative tools, maps do more than merely present spatial data. Maps are used to make arguments (Harley, 1989; Muehlenhaus, 2011; Wood & Fels, 1992). It has been shown that maps play a key role in shaping people’s beliefs about their environment and the world around them. In many cases, particularly outside of academia, maps are created and presented with the intention of promoting or reinforcing a particular belief (Koch, 2004). A classic example of this is the standard highway map that proliferates in glove compartments around the world. Originally it was distributed by oil companies hoping to promote petrol consumption via increased automobile travel (Akerman, 2002). They have also been used by different government agencies as tools to promote patriotism and tourism (Wood & Fels, 1986). Beyond marketing, maps are frequently created with the sole purpose of political persuasion (John
Pickles, 1992). For example, case studies abound showing that maps have been used by political campaigns (Edsall, 2007), national governments (Herb, 1999; Zeigler, 2002), and non-profit groups to outright lie or misrepresent others’ claims to legitimacy in public debate (see Figure 1).

(Figure 1 around here)

An important question remains largely unanswered, however: how are these cartographic arguments crafted? Are there any standard cartographic rhetorical styles used to construct persuasive maps? As is the case with other forms of communication, e.g., writing and speaking, different techniques of presentation can add rhetorical flair to the argument being presented in a map. Monmonier (1996) used a variety of case studies to show just how varied the techniques of lying with maps can be. Muehlenhaus (2011) has shown that in contrast to other realms of cartography, basic design techniques found in persuasive maps over the past 200 years have remained remarkably consistent. For example, manipulative techniques used to convince consumers about the ubiquity of different mobile phone networks are similar to those found on North American maps from the 1800s showing the breadth of a certain railroad networks. Muehlenhaus (2011) also illustrated that persuasive maps may possess a parallel but distinct genealogy from thematic maps.

In many ways, analyzing scientific maps is more straightforward than figuring out how to analyze persuasive maps. With a scientific map, one can evaluate the different fundamental components found therein to see if they adhere to the principles of clear communication as established by years of cartographic literature. For example, one can check if the map uses an appropriate projection, appropriate symbolization, and follows established rules of visual hierarchy. The problem with reusing these same techniques to critique persuasive maps is that many of the cartographic rules and methods of analysis were developed by academics whose chief concern has been map accuracy and data clarity. The omnipotence of these cartographic norms for all map purposes is dubious at best, largely reinforced via years of case studies.
focused on the study of accurate map interpretation and axioms regarding what makes information graphics good.

Tufte has been at the forefront of these myopic declarations. For example, Tufte defines graphical excellence as “well-designed presentations of data of substance, consisting of complex ideas communicated clearly, efficiently, and precisely” (1983: 51 paraphrased). Graphical excellence gives the reader the “greatest number of ideas in the shortest time with the least ink in the smallest space, is almost always multivariate, and requires telling the truth about the data” (Tufte, 1983: 51 paraphrased, emphasis added). This argument may be valid for designing certain kinds of graphics and maps, but only if and when clarity is the designer’s chief goal.

What, though, makes clarity, complexity, and accuracy a more excellent goal than rhetorical and emotive efficacy? A rebuttal to this question has never been successfully provided by information architects. If fact, evidence is mounting that people make up their mind about visually displayed information in seconds, not in the minutes required to interpret multivariate, data rich, truthful visualizations (Gigerenzer, 2007; Gladwell, 2005; Olson, 2009; Ware, 2008). (Case in point, when was the last time the reader honestly looked at a multivariate proportional symbol map and attempted to accurately determine a quantitative, instead of ordinal or subjective, difference between the values presented between two circles?) In many cases, people interpret datasets not only more quickly but more accurately when they are presented with less, not more, data detail (Gigerenzer, 2007; Gladwell, 2005). Research has shown that people are far more likely to be moved into action, or swayed into seeing something, by things of a rhetorical nature than rationalist logic. Show someone an “excellent graphic,” perhaps a meticulously complex, clear, accurate, and multivariate chart of the number of whales killed every year in the name of science. Show that same person an artistic, and perhaps downright gratuitous, flow map of different countries’ explosive harpoons penetrating a whale. Which graphic will stick in the map readers’ memory longer? Which image is more likely to persuade the person to be opposed to whaling? Which one is “excellent”? A rationalist would say the first map, as it
clearly presents rich data about whaling in an objective manner. Of course, the purpose of
designing such a map is rarely to be objective, no matter what the designer believes. If the goal
of these visualizations is to convince an audience that international whaling in the name of
science is something that needs to be ended, and not to simply vomit up “objective data,” the
latter is likely the better.

Thus, evaluating maps based solely on their adherence to established cartographic or
information visualization techniques is biased; biased against persuasive maps. These norms
are not sufficient methods for evaluating all maps broadly, but rather, for evaluating a
particular genre – maps designed for clear communication. They are based on map norms
established by people who believe it is unethical to purposefully create biased maps – even
though many of these same people admit that all maps are loaded with inaccuracies and bias is
unavoidable. Many such academic beliefs about maps are based on institutionalized axioms;
axioms that do not necessarily hold when tested on maps not created in the academe.

A philosophical debate over what makes graphic communication effective does not only
afflict cartography. A conflict of interest between information architects and rhetorical designers
has been ongoing in graphic design for years. Though information and persuasive design are
certainly not mutually exclusive (McCoy, 2000), there exist very real philosophical differences
between the two design goals. Information architects tend to believe that data is representative
of truth; the sanctity of a dataset should not be tampered with so that the viewer can draw a
logical conclusion from it. Compare this to the graphic design of data found in an advertisement
or pamphlet. If the goal is not to display information clearly but to sell someone something – be
it an item, service, or belief, whatever – any method of visual rhetoric is fair game. If data
support one’s argument, then of course information visualization may help visually persuade
an audience. Perhaps nothing speaks sophistication like including a sparkline showing a trend
that supports your argument; conversely, if data trends go against what you are arguing, better
visualization choices might be employed. Contrary to what Tufte (1983) seems to imply, and
what many cartographers might argue, ignoring data that goes against your message is not by default unethical. We see it all the time in written and verbal debate. Moreover, studies continually show us that logical, data-driven arguments (e.g., human-caused global climate change) often whither when confronted by emotionally more powerful arguments (e.g., carbon trading will lead to job loss). Emotion and empathy have their place in decision making too – regardless how much rationalists might not like it (Olson, 2009).

In fact, unlike many cartographers, graphic designers make calculations about when to use logical versus rhetorical design techniques all the time. Tractinsky and Meyer (1999) conducted a study illustrating just this. They discovered that when designing graphics for themselves, people tend to follow many of Tufte’s axioms of graphical excellence – e.g., avoiding chart junk. However, when asked to design the same information for their bosses, or a public audience, the subjects in their study completely ignored these rules and took artistic license with the data. The reason was not because they suddenly became bad designers. Rather, designers believe – apparently have learned through years of experience – that people are more impressed by many of the things Tufte espouses are detrimental to intelligent graphic design (Tractinsky & Meyer, 1999). Chart junk and superfluous graphics, when used well, impress people, regardless of how easy it is to compare two lines to one another on a chart.

Again, assuming cartographers are selective about when to design clearly versus rhetorically, we cannot evaluate persuasive maps based solely on how well they subscribe to established scientific visualization norms. We need to begin analyzing the nature of persuasive maps by looking at how they are composed differently from scientific ones. It is the hope of this author that if we start analyzing persuasive maps from scratch, we may begin determining how persuasive maps can be evaluated with one another based on their own merits. Then, hopefully, we can start to effectively study their design as a separate genre of maps.

The rest of this article presents the results of a quantitative content analysis conducted on 256 persuasive maps produced between 1800 and 2008. This analysis individually scrutinized
256 maps for 192 different data, graphic design, and layout manipulation techniques. Using this data, cross-tabulations were run on all of the different maps and manipulation variables to see if different data manipulation and graphic techniques often went hand-in-hand in the persuasive maps, and if so, which relationships were significant. The results show that many types of manipulation tend to correlate with one another. Also, several of the most established beliefs concerning how persuasive maps are constructed – e.g., inappropriate projection and visual variable use (Monmonier, 1996) – were found to be irrelevant in this dataset. The goal of this research is to test certain axioms about persuasive maps to see if they are actually true or false, as currently our knowledge about these maps is largely based off of anecdotal evidence.

Methodology

From 2007-2009, 256 persuasive maps were sampled from different national and regional map libraries as well as the Internet. The origins of the maps ranged from atlases to wall maps and from magazines to books. An effort was made to collect maps from the dawn of modern thematic mapping, circa 1800 (see Robinson, 1982), to the present and to also collect maps created by a variety of different producers, including corporations, governments, non-profits, and unaffiliated individuals. The data sample and has been reviewed elsewhere (Muehlenhaus 2010, 2011a), and thumbnail images of many of the maps used in the study are available online at www.ian.muehlenhaus.com/mapsample/.

Quantitative content analysis was used to compare the maps to one another looking for similarities in map composition. Quantitative content analysis (QCA) is a qualitative methodology ideally suited for determining any trends, correlations, and relationships among multiple variables in large datasets (Riffe, Lacy, & Fico, 1998). As the name implies, the chief benefit of QCA is that one can quantify nominal level data for statistical analysis. In this case, once all of the maps were analyzed, it was possible to measure differences and similarities in their composition.
Maps were analyzed via a coding process. Each map was scrutinized by identifying the existence of, and in some cases measuring, specific predetermined design elements (Muehlenhaus, 2011b). Each map in the sample was analyzed in exactly the same manner, using the same codes. The coding resulted in a spreadsheet with a row for each map in the sample and columns containing values for each coded variable (in this case 192). For example, one of the codes was “extent of areal coverage.” Each map was coded using one of the following pre-defined values: local, provincial, regional (sub-country), regional (sub-continental), country-wide, continental, hemispheric, or global. In the end, it was possible to look at the sample and compare how frequently maps covered different extents of the world. Moreover, this value could be cross-tabulated to determine if map extent correlated strongly with any of the other codes.

The codes used in this study, and the process by which this quantitative content analysis was conducted, have already been covered extensively in previous literature (Muehlenhaus, 2010, 2011a). After two pilot coding sessions, 192 codes were defined and used to analyze the 256 persuasive maps in the sample (the codes are available in Muehlenhaus, 2010). Many of these codes were based off of what previous literature had argued were standard techniques of data and graphic manipulation found in persuasive, advertising, and politically motivated maps (see for example the following sources: Black, 1997; Monmonier, 1996; John Pickles, 1992; Starkey, 1942; Tyner, 1982; Wood & Fels, 1992). The codes were derived from three realms of map design, based off of both cartographic and graphic design literature.

MacEachren (1995: 351) argues that maps communicate their messages in two ways – connotatively and denotatively. Connotative communication is that which is largely subliminal – messages communicated by what is left unmentioned. Denotative communication is information which is readily available for interpretation via the graphics and symbology
presented on the map itself. Every map uses both methods of communication, he argues, and thus, understanding maps requires a holistic analysis of both.

MacEachren’s (1995) breakdown of map communication into these two dimensions is useful, but is largely geared toward understanding how people interpret maps, rather than focusing on the cartographic techniques and processes behind their creation. The codes used to analyze these maps’ compositions, though, were created with both connotative and denotative communication in mind. Codes were devised to cover three realms of map design. The first category dealt with connotative communications, referred to here as Data Model Manipulation. Codes were devised to investigate projections, data levels of measurement, appropriateness of the visual variables used in conjunction with the data, data accuracy, and many more. The second category of codes was established off of denotative communication, referred to hereon as Graphic Manipulation. Graphic manipulations are design decisions that the map reader can visually perceive. Whereas data model manipulation is largely invisible, i.e., done behind the scenes and largely unnoticeable without critical observation, graphic manipulation consists of things such as color choices, level of visual contrast, illustration inclusion, and numerous other realms. The term manipulation is not pejorative here; cartography is a continual process of data and design manipulation. Manipulation merely refers to the data and design decisions that the cartographer made while creating the persuasive map. The cartographer manipulates reality to communicate a message.

As already mentioned, however, it is the belief of this author that the analysis of cartographic manipulations can only tell us so much about maps – particularly persuasive ones. To garner more information about the actual rhetorical nature of these maps as persuasive
graphics, a third realm of codes was developed from graphic design theory. Specifically, 16 Likert-style codes were created based off of Dondis’s (1973) work on graphic design. Dondis (1973) argues that all graphics can be analyzed and compared to one another depending on how they are artistically comprised. She proposes that images can be broken down by analyzing where they fall on multiple axes of graphic manipulation. For example, every image (be it a photograph, painting, or map) can be analyzed and ranked as to where it falls on a design axis between “dynamic” and “static.” An image that evokes movement regardless of how it is done (e.g., via blurring, flow lines, or oblique angle) will fall closer to the dynamic manipulation end of the axis, and vice versa, an image that evokes stillness will fall closer to the static manipulation end. Dondis notes that images tend to fall closer to one extreme or the other. She also proposed that her original realms of design manipulation (the axes she came up with) could be tweaked to better suit the type of image one is analyzing. Thus, the author modified her design manipulation axes to better pertain to maps. Codes were specifically defined for each of these axes so that all of the maps were evaluated using exactly the same way. The resulting codes and their definitions were previously published (Muehlenhaus, 2011a) and are reprinted with slight modification below by permission (Figure 2).

(Insert Figure 2 around here, adapted from Muehlenhaus, 2011a, permission secured)

After coding all of the data, trends were analyzed by tabulating all of the results and seeing what traits manifested themselves within persuasive maps. These results are discussed in the next section. Beyond merely describing what the sample looked like, of primary interest was how the different types of data, graphic, and layout manipulations correlated with one another – did certain types of graphic and data manipulation act as indicators of other types? Were there correlations among the different variables, and if so, how did they line up with what we believed we knew about persuasive maps before. Could any of these correlations give us insight
into what makes persuasive maps different from cartographic maps beyond what we know already?

To answer these questions, cross-tabulations were run in SPSS across all of the variables coded. Significance tests were also run to see if what appeared to be correlations were actually significant. The aggregate results of this study disputed and reinforced many established beliefs concerning persuasive maps.

**Analysis: The Composition of Persuasive Maps**

One of the most noticeable traits about persuasive maps is that they rarely show anything more than nominal level data. 66% of the maps only showed nominal level data; ratio level data was second but found in only 16% of the sample. Nominal level data is qualitative in nature, based on categorization. If data is shown at the nominal level, it can be more difficult for map readers to make nuanced interpretations of the data. In many cases, data that is easily accessible at interval or ratio levels was apparently dumbed down to be shown nominally. Whereas in scientific cartography accuracy, detail, and data clarity is the norm, in persuasive maps, qualitative data is typical, if not more appropriate for rhetorical emphasis (see Figure 3 for an example).

(Insert Figure 3 around here)

Due to their ability to distort shape, area, direction, and distance, one would presume that projections are ripe for manipulation in persuasive maps. However, the manipulation of projections for purposes of persuasion did not come to fruition in this sample. Though a majority of maps were of indeterminate projections, more maps used cartographically appropriate projections than inappropriate ones (24% versus 11% of the sample). On the other hand, 70% of the maps in this study had neither a graticule nor a north arrow. A map scale of any type was absent on 57% of the sample. Basically, orientation was indeterminate on a
majority of the maps. This seems to be another trait separating persuasive maps from cartographic ones.

A variety of other map data manipulations were coded for and yielded unforeseen results given previous literature concerning persuasive maps. Data sources were missing on less than 50% of the maps; the date of map creation or data accuracy was missing on only 25% of the maps; and the name of the cartographer or agency producing the map was available on over 90% of the sample. Finally, the inappropriate use of visual variables, something lauded in the literature as one of the main methods of map manipulation, was only found on 10% of the maps. This is remarkably low considering that maps are still regularly published in scientific journals that use inappropriate visual variables. In fact, this technique of cartographic manipulation was simply a non-factor among the persuasive maps in this sample.

Pertaining to map representation, several findings were notable. The most frequently used visual variable in the sample was hue. This correlated with the fact that a majority of the maps only showed nominal level data and the inappropriate use of visual variables was extremely rare; hue is a suitable visual variable for nominal level data in most circumstances. Second to choropleth maps, the most common type of thematic representation was flow arrows. Just under 20% of the persuasive maps in this sample were flow maps, compared to 33% choropleth. 10% of the maps used mimetic dot symbols of some type, often in conjunction with other thematic representations.

The style of a map’s title was also analyzed. It turns out that using a flamboyant or confrontational title is not as common on persuasive maps as previous literature on propaganda maps might lead one to believe. Only 17% of the maps sampled used a “confrontational” title. This is likely higher than would be found on scientific maps, but still not as common as might be expected based on previous literature.
Other features that were thought to accompany persuasive maps based on the literature were also analyzed. 28% of the maps had artistic illustrations either around or over the mapped area; only 6% made use of photographs. This is likely a higher rate than would be found in most scientific visualizations, as there is common consensus among modern cartographers that artistic accompaniments to maps are “chart junk” (Tufte, 1983). That may be true when trying to accurately show data; however, when it comes to persuasive cartography, superfluous illustrations appear to have a role as emotive devices. This has been found to be the case in persuasive graphic design literature as well (Tractinsky & Meyer, 1999).

All maps were coded using the Likert-map design variables (based off of Dondis’s work) discussed above in the methodology section (see their median scores in Figure 1 above). Unfortunately, the author is unaware of any studies done on cartographic maps using this method of analysis, so these results must stand largely on their own. However, the results proved useful, as will be shown in the cross-tabulations analysis in the next section.

Based on the aggregate analysis, it is evident that certain data, visual, and layout manipulations play a significant role in how persuasive maps are designed to communicate to map readers. Many of the characteristics of persuasive maps contest the wisdom of modern geovisualization norms – e.g., no scale, generalizing data to the nominal level, and making heavy use of chart junk. Though these attributes may be shunned in scientific cartography, and may even work against clearly understanding data that is being presented, they obviously are considered effectual by the designers of persuasive maps. Aggregate analysis can only help us understand so much, however. In the next section, correlations among these variables are tested to determine if any unique, and unforeseen, relationships among these variables exist in the composition of persuasive maps.

**Analysis: Correlation among Persuasive Map Variables**
Though the descriptive statistics in the previous section help to shed light on what characteristics are common, or not, among persuasive maps, they do not necessarily help us better understand how such maps are comprised. In order to get at the heart of their composition, the next step was to test relationships among the data and design manipulation variables in the sample. To do this, cross-tabulations and Cramer’s V coefficient tests were run between all 192 variables in the dataset. Most of the correlations were insignificant, and many among those with moderately significant relationships were obvious (lack of a map scale correlated heavily with a generalized base map). There were several unexpected relationships, however, that are worth reviewing here.

**Exclusion of Map Scale**

The exclusion of a map scale was a strong indicator that other types of data and graphic manipulation are likely to be found on a given map. In particular, the lack of a map scale increased the likelihood that: (1) a map’s orientation would also be missing; (2) the visual hierarchy of the map would be simplistic; (3) the projection would be inappropriate; and (4) the map would be lacking a legend of any kind.

**Inclusion of Supplemental Illustrations**

The inclusion of non-photographic illustrations both over and around the mapped area resulted in more significant relationships with other variables than any other variable. As noted in the previous section, persuasive maps frequently included illustrations; those that did were significantly more likely to: (1) use mimetic or pictorial map symbols instead of geometric ones; (2) be “non-scientific” in appearance, as defined by the Dondis codes; (3) be broken into multiple parts, leading to a more fragmented layout; and (4) have more dynamic and active representations, as defined by the Map Style codes (see Figure 4 for an example).

(Insert Figure 4 around Here)
The Inclusion of a Publication Date or the Date of the Data Being Mapped

The exclusion of any form of date on a map proved a strong indicator for several types of cartographic manipulations. For example, data and map maker are intrinsically entwined. Maps that excluded either the date or the name of the map producer excluded the other 64% of the time. Maps were significantly more likely to use extremely generalized spatial data when a date was omitted from the map (47% of the time versus 15% of the time when a date was included) and were also more likely to have extremely generalized base maps (see Figure 5 for an example).

(Insert Figure 5 around here)

Map Contrast and Colors Used to Establish Contrast

There was a relationship between high visual contrast and the use of colors to establish visual contrast. The data correlated to what had already been empirically noted in previous studies (see for example Monmonier, 1996); throughout the sample, red and black were most often used for creating extreme contrast. These were followed by yellow, orange, and purple.

Summary of Data and Graphic Manipulations in Persuasive Maps

Numerous relationships exist among the different types of manipulations coded. However, some were stronger than others. In general, relationships were relatively weak (with a Cramer’s V value above 0.2 but less than 0.3), but several variables were significantly linked to many others (e.g., the inclusion of map scale to the likelihood of accompanying illustrations).

In fact, several variables appear to act as indicators that a map is likely to contain other types of cartographic manipulation. Generally, when a map left off certain details about the map producer, scale, date, or data source, it left off details about most of those elements – not just one. Maps sans any one of these variables were also far more likely to have a generalized base map and, to a lesser but still significant extent, generalized data.
The appropriateness of map projections was also linked with many other variables. Choropleth maps were more likely to use inappropriate projections, as were maps with generalized base maps. If a map had an appropriate projection, the odds that the map was encumbered with many other types of data model manipulation dropped precipitously.

One of the most renowned misdemeanors of scientific cartography – i.e., inappropriate use of visual variables – was a non-issue in this sample. Only 7.4% of all maps used inappropriate visual variables. Moreover, visual variable abuse did not correlate with any other variable. It appears that the misuse of visual variables is more likely to be the result of poor design, rather than any overt political calculation. There were some notable exceptions, however (for example see Figure 6).

(Insert Figure 6 here.)

As for graphic indicators, whether or not a map possessed illustrations, textboxes, charts, and inset maps had a variety of influences on the nature of the map. Illustrations were the most interdependent variable, but all of the above traits made maps appear more fragmented. The thematic representation of a map had fewer relationships than the supplemental map items. The only significant correlation with thematic representation was that choropleth maps were almost exclusively two-dimensional, whereas other thematic maps were more likely to use oblique perspectives.

These cross-tabulations of categorical map variables tell us much, but they do not convey the entire picture when it comes to understanding the types of manipulation found in these maps. Persuasive maps are not the only type of maps omitting an orientation or the name of the cartographer – many maps do. Though useful for identifying major differences between how persuasive maps and scientific maps are made, it is impossible to analyze persuasive maps based solely on their use, or neglect, of cartographic norms. Fortunately, the maps were also coded for the style and rhetorical nature of their layout using the continuums based on the work
of Dondis (1973). Testing for relationships among these layout variables shed more light on how different political cartographic manipulations were designed to communicate rhetorically.

**Relationships among Map Design and Layout Variables**

The most intriguing interrelated variables were those dealing with map design and layout (i.e., the ones developed from Dondis’s theory of image manipulation). Many of these ordinal variables related to one another in complex ways. Due to the fact that the map layout variables were ordinal measurements, the nature of these relationships among these variables could by analyzed using Chi-square, Pearson’s correlation, and Spearman’s rho. Many of the layout variables had dependent relationships, the most significant of which will be reviewed below.

Spearman’s rho tests were used to gauge the initial strength of a relationship among variables with a significant Chi-square and Pearson’s correlation. Both of Chi-square and Pearson’s correlation were used, because even though the data was ordinal in nature, it has been argued that seven-point Likert-scales are continuous enough to use Pearson’s correlation as well (O’Brien, 1979). The reason that Spearman’s rho was used to determine the final value of the relationships, as it does not eliminate tie rankings from its analysis. With 256 cases and only a seven-point Likert scale, tossing out ties (as Kendall’s tau-b does for example) was not a viable option.

Persuasive maps were far more likely to appear scientific when the data represented was specific. Maps using heavily generalized data or base maps were more likely to be non-cartographic in appearance. Data specificity makes certain persuasive maps appear more objective and fool-proof. A generalized base map had a great influence on other design variables. Maps that were non-cartographic were also more likely to have simple visual hierarchies than more scientific-looking maps. However, this was not always the case. Non-cartographic looking maps were also more likely to make use of extreme visual contrast.
Maps that had oblique perspectives were more likely to represent the data in both a dynamic and emotive fashion. Top-down, planimetric representations often meant the map would also appear more static. Maps with a traditional, planimetric view of the world were more likely to use simplistic geometric symbology than maps with bird’s eye or more oblique views.

Several other significant correlations existed among the Dondis-based variables. Emotive symbols were more frequently found on dynamic maps than static ones. Geometric symbols correlated with stability as a whole. The more fragmented a map’s layout, the more likely the map was to be visually unbalanced. In contrast, maps with relatively organic (i.e., smooth) layouts were typically more visually balanced. The most intriguing aspect of the relationship about these two variables is that it is not strong. A significant positive relationship existed between the level of detail in the mapped data and the level of detail found in the base map underlying the data. However, in many cases extremely detailed base maps were used with very simplistic thematic data. Dynamic maps also tended to have a more easily discernible visual hierarchy than static representations, which tended to flatten the map layers.

The results of all of these tests, as well as graphs showing the correlations are available online at http://ian.muehlenhaus.com/professional/index.php/publications/dissertation-a-data.

Review

As has been hypothesized anecdotally in the literature for decades, the above tests demonstrate that data, graphic, and layout manipulations are often interrelated on persuasive maps. Based on the data from this sample, we can argue that yes, certain cartographic manipulations in persuasive maps come in pairs and are associated with one another.

In fact, in this sample, the map layout and design variables based off of Dondis (1973) were more important in determining the internal nature of a persuasive map than any of the variables
based off of the scientific literature on maps. In particular, the following layout variables seemed to be extremely important in the composition of persuasive maps:

- Base map generalization;
- Non-cartographic versus scientific display;
- Emotive versus geometric symbology;
- Complex versus simple hierarchy; and
- Dynamic versus static representation.

These five variables had strong relationships with many other layout variables, as well as many standard cartographic data and graphic variables (reviewed in the previous section). They appear to be central in determining the rhetorical style and nature of a persuasive map.

One of the most unique relationships in the dataset was with the non-cartographic/scientific variable. Non-cartographic maps (defined in the codes as those that do not appear to adhere to academic cartographic norms) had the most complex visual hierarchies and most specific data. This may be due to the fact that many non-cartographic maps disregard scale, use unique perspectives, illustrations, and often embed the map within a larger graphic image, resulting in a more intricate appearance. Official and scientific looking maps that are less likely to shy away from listing the cartographer, a map scale, and source data, actually communicate less due to data simplification, classification, or simple deletion. Non-cartographic maps likely have more complicated visual hierarchies because they use more emotive icons, have more illustrations, and are less likely to kowtow to certain cartographic standards (for example, north at the top).

Dondis’s theory of graphic design analysis was useful for uncovering characteristics about how persuasive maps communicate their messages. It is the hope of this author that this technique of analyzing the nature of maps might be used further to study the rhetorical nature of other kinds of maps as well.
Conclusion

Arguing that a map is no good or subpar because it does not follow scientific principles is no longer acceptable. Maps are best critiqued on how effectively they achieve their communicative purpose. The goal of some maps is to communicate data as accurately, clearly, and richly as possible. I have referred to these types of maps as scientific but another term might be logical, as they are crafted using the tenets of scientific cartography to present a logical argument based on clear evidence to the map reader. These scientific maps go by many names, including but not limited to: geovisualizations, thematic maps, and reference maps. On the other hand, some maps are not designed to present logical arguments or accurate and scientifically valid data. Such maps have been referred to here as persuasive but might in the future be better named rhetorical. These have very different communicative goals from scientific maps. These rhetorical maps are used to convince, reinforce, cast doubt upon, or inspire certain beliefs and ways of thinking about the world. As the previous analysis demonstrates, persuasive maps are often designed differently than scientific ones. Critiquing persuasive maps based on how well they ascribe to the rules guiding scientific maps does nothing to help us understand them.

It has previously been argued that persuasive maps have a separate genealogy from scientific maps (Muehlenhaus, 2011a). It is the argument of this author that persuasive maps are a special category of map unto themselves, within which there are surely numerous subcategories that merit further exploration in the future (e.g., maps of desire, maps of fear, maps of danger, maps of promotion). The reason persuasive maps are composed differently from scientific maps is not due to a disregard for the discipline of cartography but because they fulfill a different role in society. The difference between scientific and persuasive communication is not unique to maps. It can be found in the different approaches that the BBC and blogger journalists have when it comes to covering current events. The BBC presents the news in a clear, factual, and thorough manner, whereas a blogger might interject her own views and opinions
into the reporting. No news program is completely objective – nor is any map. Persuasive maps, however, will often hold no pretense of being objective, whereas scientific maps often will.

Like all maps, at their root persuasive maps are simply visual tools of communication. Unlike scientific maps, which aim for objectivity and neutrality in their representations of data – something that is acknowledged by nearly all to be impossible – persuasive maps have no such limitations. Makers of these maps use every design tactic at their disposal to create maps that inspire or mollify their audiences into seeing an aspect of the world in a particular way. This does not make these maps less worthwhile of study. Indeed, since they likely have a great impact on society and audiences in general, it is this author’s belief that we should be more actively attempting to understand how these maps work.

This study was a first attempt to begin analyzing how persuasive maps are crafted. It found that typical persuasive maps, at least as sampled, go against many of the beliefs about them established in the cartographic literature. This study also found high levels of synchronicity between numerous data and graphic variable manipulations, many of which would be shunned by designers of scientific maps. Finally, certain map design and layout techniques correlated with one another at significant levels, which we can now focus on in future research to better understand how persuasive maps are composed.

This research is by no means fool proof and should be thought of as an initial exploration into the composition of persuasive maps, not the final word. There are some serious limitations that must be noted. First, the content analysis on which this study is based has not been tested for replicability (see Muehlenhaus, 2011a for information on this). Second, the sample was not random. Though every attempt was made to choose a variety of persuasive maps created by different authors, at different times, and published on different mediums, the results may change if more maps are added to the study at a later date. Finally, some of these relationships, though significant, were relatively quite weak.
Exploring the nature of persuasive cartography using a large sample has allowed us to better understand how these maps are composed, so that we can begin to analyze and engage these maps on their own terms, based on their own cartographic norms. However, by breaking persuasive maps down into composite parts, it may become dangerously simple to lose these maps’ meaning for cartographic communication. This study is but the first step on a holistic exploratory ladder.
Acknowledgements

The author would like to thank the anonymous reviewers for their insightful, and much needed, feedback of an earlier version of this manuscript. Thanks also to the American Geographical Society Map Library at the University of Wisconsin – Milwaukee for offering me a McColl Fellowship to conduct research using their collection. Robert McMaster, Scott Freundschuh, Steven Rosenstone, and Roger Miller were also instrumental in helping this research come to fruition.
References


Figure 1. National Highways Association map (1918) soliciting support for road building in the United States: “Some for War! Some for Defenses! Some for Peace!!!” (from the AGS Map Library, available online http://goo.gl/iR9i4)
Figure 2. Dondis variables redefined for the analysis of persuasive maps (with sample average Likert scores).

Table showing Dondis variables and their definitions.
<table>
<thead>
<tr>
<th>Likert Scale</th>
<th>1</th>
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<th>4</th>
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<td>A map using extreme graphical contrast to present different types and/or values of data.</td>
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<td>A map comprised of many interdependent symbols and graphics across numerous levels of the map's visual hierarchy.</td>
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<td><strong>SIMPLE HIERARCHY</strong></td>
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<td>A map with minimal spatial data and few map elements, offering a very simple and clear data representation.</td>
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<td>A thematic map that uses a combination of visual variables and/or styles of representation to show multiple types of data.</td>
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<td>A thematic map illustrating only one primary dataset, using only one style of representation.</td>
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<td>A map comprised of culturally, socially, or politically significant mimetic symbols.</td>
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<td>A map comprised of simple geometric shapes and symbology.</td>
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<td>A map visually discerning intra-data differences on the map for visual comparison and/or quantification.</td>
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<td>A map using symbology and representations that make data differences incomparable and unquantifiable.</td>
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<td>A base map emphasizing referential accuracy, precisely representing data with little generalization given its scale.</td>
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<td>A base map distorting reference units to the point that absolute spatial calculations are impossible.</td>
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Figure 3. An example of the benefits of dumbing down data to the nominal level – if any part of a state is exposed to potentially deadly radiation, the entire state gets labeled as deadly. (Map created by Author based off of erroneous data.)
Figure 4. An example of a persuasive map including illustrations, this one by Richard Edes Harrison, in a *Fortune* article entitled “Ethiopia at Stake” (1935).
Figure 5. An example of a nameless and dateless persuasive map. This map became ubiquitous after the 2004 United States Presidential Election in which President Bush beat Senator Kerry. The origins of this map are unknown to most people. It was simply a post to yakyak.org the day after the election. Within days it became what the *New York Times Magazine* described as an “instant Internet Classic.”
Figure 6. The most commonly misused visual variable – according to scientific visualization – was color hue instead of color value, as evidenced on this recreation of a delegate map from candidate Barack Obama’s Website in 2008.