Genealogy That Counts: Using Content Analysis to Explore the Evolution of Persuasive Cartography

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Abstract
Maps are often used for persuasive purposes. Yet little is known about whether or not different persuasive map producers use similar cartographic techniques or about how such techniques have evolved through time. This article explores the genealogy of persuasive map design by analyzing 256 such maps published since 1800. Quantitative content analysis is used to break down each map among 190 contextual, data, design, and layout variables. Cross-tabulations and descriptive statistics are used to test whether and how the characteristics of persuasive maps have changed over time and differ by type of producer. The results illustrate that although some persuasive techniques have changed over time and by producer, most techniques are recurring and used by all types of producers. The results imply that different techniques of persuasive cartography are largely timeless, regardless of producer or medium. It is also argued that content analysis may prove a useful method for other research in map genealogy.

Keywords: persuasive cartography, quantitative content analysis, map history, propaganda maps, cartographic design

Résumé
Les cartes sont souvent utilisées dans un but de persuasion. Toutefois, on ne sait pas vraiment si les divers producteurs de cartes persuasives utilisent tous les mêmes techniques cartographiques. On ignore aussi comment ces techniques ont évolué. Dans l'article, on explore l'évolution de ces techniques en analysant 256 cartes persuasives publiées depuis 1800. À l'aide d'une analyse du contenu quantitatif, on évalue chaque carte en tenant compte de 190 variables relatives au contexte, aux données, à la conception et à la disposition. Des tabulations recoupées et des statistiques descriptives sont utilisées pour déterminer si les caractéristiques des cartes persuasives ont changé avec le temps, et pour analyser cette évolution le cas échéant. De plus, on évalue les différences qu'on trouve entre les divers types de cartographes. Les résultats montrent que même si certaines techniques persuasives ont changé avec le temps ou d'un cartographe à l'autre, la plupart des techniques sont récurrentes et sont utilisées par tous les types de cartographes. Ces résultats supposent que certaines techniques de cartographie persuasive sont grandement intemporelles, peu importe le producteur ou le soutien technique. L'analyse du contenu pourrait aussi s'avérer une méthode utile pour d'autres recherches en généalogie cartographique.

Mots clés : cartographie persuasive, analyse du contenu quantitatif, histoire de la cartographie, cartes de propagande, conception cartographique

Introduction
It is well established that maps can be created and used effectively as rhetorical devices to communicate arguments or reify societal norms (Harley 1989; Koch 2004; D. Wood and Fels 1992). Though all maps are biased, some maps are more biased than others; they are designed specifically to convince or sway an audience into seeing an
Exploring the Genealogy of Persuasive Cartography

Previous research has demonstrated that different types of cartography have unique and discernible evolutionary tendencies that are better understood when studied on their own and not merely subsumed within broader cartographic and/or political contexts. Alan MacEachren (1979) and Arthur Robinson (1982) successfully analysed the history of thematic maps as a distinct category from cartography as a whole. The histories of cadastral and state-sponsored mapping have also been evaluated extensively (Konvitz 1987; Pickles 2004). The historical trends of persuasive cartography have not been studied so closely. One obstacle to such an endeavour has been that the goals of persuasive maps differ markedly from those of scientific maps, with the result that standard notions of cartographic development become largely irrelevant. In cartography broadly, progress is typically equated with increased accuracy (but see Edney 1993a, 1993b, for critiques of such views). Yet, since accuracy is not an inherent goal of persuasive cartography – indeed, it is often to be avoided – the evolution of this cartographic subfield is not likely to parallel, much less fit neatly into, that of scientific cartography as a whole.

Matthew Edney (1993a) and David Matless (1992, 1995) posit that a more enlightening approach for understanding the evolution of different sub-types of maps might be found in Michel Foucault’s concept of genealogy – a form of history that patiently documents change over time in a non-linear fashion (Foucault 1986a, 76). In genealogy, the origin of everything represents a dissension from other things. There is no concrete beginning or end to any historical innovation or process – there is no “progress.” Using genealogy, history provides no benchmark moments to which later developments can be compared as better or worse (Matless 1995); in fact, it fragments unified histories into more nuanced and non-linear specifications (Foucault 1986a). Thus, genealogy is different from traditional historical approaches in that it simply documents change and is

a form of history which can account for the constitution of knowledges, discourses, domains of objects etc., without having to make reference to the subject which is either transcendental in relation to the field of events or runs in its empty sameness throughout the course of history. (Foucault 1986b, 59)

In sum, genealogy is a method of historical analysis that simply looks at evidence of change and documents these changes over time, without passing judgement and without describing evolutionary events as progressive or detrimental. Moreover, it is useful for breaking established histories into smaller composite processes with their own evolutionary trends.

Little is known about the genealogy of persuasive cartography – a genealogy lacking any grounding to scientific accuracy. The goal of this article is to offer a holistic approach for exploring the genealogy of persuasive maps. I test the usefulness of this new method by focusing on two questions pertaining to the history of these maps: (1) Do the cartographic properties of persuasive maps change dramatically over time? and (2) Do the cartographic properties found in these maps correlate with their producers (e.g., governments, news magazines, or corporations)?

The rest of this article proceeds as follows. First, the proposed methodology – quantitative content analysis – is discussed. Next, the results of my analysis pertinent to testing persuasive maps’ evolution over time and among producers are highlighted. A discussion of these results
follows, and the article concludes with the limitations of content analysis in this work and how this method may be used effectively in further research on the genealogy of maps.

Methodology

Quantitative content analysis (QCA) is well established in the social sciences as a reliable and insightful method for the holistic analysis of qualitative data. Though originally developed for the analysis of texts, it is now widely used to analyse the content of images, videos, and even video games. Gillian Rose (2007) defines QCA as a qualitative method that allows for data quantification – that is, the metric analysis of one’s results. This method is particularly effective for measuring and statistically comparing the strength of qualitative differences and correlations within large samples.

Though QCA has been embraced by human geographers to study images – perhaps most famously, to analyse how indigenous groups have been portrayed in National Geographic magazine throughout time (see Lutz and Collins 1993) – cartographic analysts have rarely used this method (a notable exception is Edsall 2007). QCA continues to thrive elsewhere, however, particularly in media studies attempting to quantify qualitative attributes and measure their correlative strengths to one another (Riffe, Lacy, and Fico 1998). For example, QCA has been used to analyse what types of graphics accompany the evening news on the major networks and how often different types of graphics are used (Foote and Saunders 1990); it has also been used to study political bias in national news coverage of different political parties (Grabe 1996). Most notably, QCA is the methodology employed in systematic analyses of the average number of acts of violence people are exposed to while watching television (Gerbner, Signorielli, and Morgan 1995).

Because maps are images (M. Wood 1994), as well as a form of media (Sui and Goodchild 2003), QCA is suitable for large-sample map analysis. Large-sample studies of persuasive maps have been uncommon, since most methods of map analysis are extremely time consuming, particularly when more than a handful of maps must be analysed at once. In studies of persuasive map genealogy, QCA may facilitate a more holistic and longitudinal analysis of variance than previous methods.

Coding

The key component underlying a successful quantitative content analysis is coding, a two-step process involving (1) the explicit definition of the variables researchers will look for in maps and (2) the systematic labelling of these variables as they are found in maps. At the conclusion of coding, codes become the maps’ statistical variables. Coding every map in exactly the same way, one can run statistical tests on the sample maps, as well as all of the variables, to look for correlations and trends. For example, do most persuasive maps that are missing a legend also use an inappropriate projection? By running a cross-tabulation on these two variables, one can find out.

In QCA, unlike many other qualitative methods (e.g., grounded theory), researchers must know before beginning the coding process what their specific research questions are (Riffe and others 1998; Rose 2007). This helps curtail the amount of coding needed for each map, yet ensures that the codes used will address the research questions being asked. The number of codes needed depends on three things (Rose 2007). First, the codes must be exhaustive; they need to cover any conceivable map variable that may have an influence on the research questions. Second, they need to be exclusive – that is, codes cannot have overlapping definitions, or the statistical results may errant because some maps have been counted twice. Third, the codes must be enlightening: they must help us answer the research questions.

The codes used to analyse the persuasive maps in this study had to be determined before my research could begin. The first step was to create a comprehensive list of previously identified cartographic techniques used for persuasive purposes. The list was compiled from previous literature on persuasive maps. Having identified these tactics and developed codes for them, I ran two pilot tests on small (< 50) groups of maps. When other unforeseen techniques and factors arose, new codes were developed to address these variables. Several codes never proved relevant in these pilot studies, and were therefore removed. Eventually, a list of 192 codes was compiled and each code explicitly defined. Each map was scrutinized for all 192 codes in exactly the same manner, which produced three different types of data measurements, depending on the nature of the coding: (1) binary (e.g., “the map has a legend: true or false”); (2) count (e.g., “the map has three inset maps”); and (3) magnitude (e.g., Likert-style scales).

CODE OVERVIEW

For simplicity’s sake, the 192 codes used in this study can be grouped into four categories based on what they were used to analyse: map context, data model properties, graphic/visualization properties, and layout properties. (A complete list of all the codes and their definitions is available online at http://www.ian.muehlenhaus.com/professional.) Contextual properties included such things as when a map was produced, who produced it, in what medium the map was originally produced, the likely intended audience, and the place of publication. Data model properties covered map characteristics that are typically invisible to non-expert map readers, including appropriateness of the projection, levels of measurement, etc.

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data classification, inclusion of data sources, and date availability. Graphic and visualization codes included the graphical components found in and around a map – thematic representation, use of visual variables, colouring style, inclusion of illustrations, supplemental textboxes, labelling techniques, title style, and so forth. While the contextual, data model, and visualization codes are interesting, they alone did not adequately highlight the rhetorical style of persuasive maps. To better understand how these maps communicate their messages, map style and layout were also analysed.

Previous studies of persuasive maps have often overlooked style and layout to focus instead on data manipulation and graphic representation. When it comes to communicating an argument, however, the style in which map data are presented is bound to play a role in persuading map readers. Graphic designers, particularly those working in advertising, have long understood that an image’s layout properties are a crucial component of its message. For more than 30 years, George McCleary has espoused the importance of map layout for communication. In his graduate courses at Clark University and the University of Kansas, McCleary has embraced the work of the graphic theorist Donis Dondis (1973) to teach effective cartographic communication.

Dondis (1973) argues that the visual styles of all images – including photos, paintings, maps, and more – can be analysed and compared to one another by breaking images down into continua of visual manipulation. For example, a map’s layout and composition will present its data either in a dynamic manner or in a manner that makes the data look static; all maps fall somewhere on the continuum between extremely dynamic and extremely static in appearance. Another example would be the level of detail found in a base map: some maps will possess extremely generalized base maps, whereas others will have incredibly detailed ones. Dondis argues that by using ordinal scales to rank images along these different continua, one can understand how an image communicates its message. By doing this for multiple images, moreover, one can compare how different images vary in their presentation styles and what style and layout techniques are often used in conjunction with one another.

Adapting Dondis’s concept to look specifically at maps, I devised 14 continua, along which each map was coded using a seven-point scale (see Figure 1). A score of 4 meant that a map was inherently balanced between the two extremes; a score of 1 meant that a map was extreme toward the left definition in Figure 1, and a score of 7 meant that a map was extreme toward the definition on the right side.

MAP SELECTION

More than 500 maps were collected that displayed overt examples of economic, political, or social persuasion. To limit the scope of the study, only maps produced and originally distributed since 1800 to audiences in Great Britain, France, Germany, Spain, Canada, the United States, and Israel were sampled at this stage. (However, more persuasive maps from other societies can be sampled and added to this study in the future – a benefit of using QCA.) There were several reasons for limiting the time frame. First, before 1800, Western societies mostly used maps to geocode and control space (Pickles 2004), rather than for rhetorical communication. Second, one goal of this research was to evaluate how persuasive maps have evolved over time; the volume of persuasive maps that could be acquired for analysis before 1800 was tiny compared to those appearing after 1800, and comparing a small sample of maps from before 1800 to larger samples from later years would result in inconclusive analyses. (Further limitations of the sample are discussed below in the Conclusion.)

For simplicity, each map was coded into one of four geopolitical eras, based on when it was produced: pre–World War I (pre-1915); World War I through World War II (1915–1945); the Cold War (1946–1989); and post–Cold War (post-1989). Eras were used instead of year of production because it was impossible to determine in which year many of the maps were produced. The time frame for each era was chosen based on established political epochs (Taylor 1996) and major technological transitions in cartography (Robinson 1982).

Many of the maps came from online sources, but most were found in map libraries around the United States, including the Library of Congress in Washington, DC; the Borchert Map Library at the University of Minnesota; and the DeWitt Wallace Library at Macalester College in St Paul, Minnesota. Sampling from the 500 collected maps was done selectively, with the goal of collecting a variety of persuasive maps from different eras and created by a variety of publishers. In the end, 256 maps were coded using quantitative content analysis.

Determining what made a map persuasive and worthy of inclusion in this study was tricky. To begin studying the genealogy of persuasive cartography, I decided to select maps produced to argue economic, political, or social positions. It is impossible to determine the intent of a cartographer; maps were therefore selected based on historical hindsight – regardless of the map’s intent, was it used for obvious economic, political, or social persuasion? Some of these maps merely reified dominant beliefs (e.g., during the 1960s, Communist aspirations for global domination); others presented fringe arguments (e.g., a post-Soviet Russian desire to take over the African continent). Often the maps were advertisements – promoting a service (e.g., cellphone provider coverage) or the success of certain political policies (e.g., the potential impact of federal immigration reform). Excluded from the sample were maps that, though obviously helping to shape map
Figure 1. Layout/Rhetorical Style Codes. These codes were broken down into seven-step scales. A score of 1 represents the definition in the left box; a score of 7 represents the antithetical definition in the right box; scores between 1 and 7 represent less extreme variations, and a score of 4 is neutral. Every map was coded on each of these 14 dimensions.
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**EMBELLISHED CONTRAST**
A map using extreme graphical contrast to present different types and/or values of data.

**MINIMIZED CONTRAST**
A map using minimal graphical contrast to present different types and/or values of data.

**COMPLEX HIERARCHY**
A map comprised of many interdependent symbols and graphics across numerous levels of the map's visual hierarchy.

**SIMPLE HIERARCHY**
A map with minimal spatial data and few map elements, offering a very simple and clear data representation.

**MULTIVARIATE SYMBOLIZATION**
A thematic map that uses a combination of visual variables and/or styles of representation to show multiple types of data.

**UNIVARIATE SYMBOLIZATION**
A thematic map illustrating only one primary dataset, using only one style of representation.

**EMOTIVE / MIMETIC SYMBOLIZATION**
A map comprised of culturally, socially, or politically significant mimetic symbols.

**SIMPLE / GEOMETRIC SYMBOLIZATION**
A map comprised of simple geometric shapes and symbology.

**RANDOM SYMBOLIZATION**
A map using symbolization that is episodic and/or that changes significantly throughout the map.

**REPETITIVE SYMBOLIZATION**
A map using symbolization that is systematic and does not change anywhere on the map.

**DATA SPECIFICATION**
A map visually discerning intra-data differences on the map for visual comparison and/or quantification.

**DATA GENERALIZATION**
A map using symbology and representations that make data differences incomparable and unquantifiable.

**BASE MAP SPECIFICATION**
A base map emphasizing referential accuracy, precisely representing data with little generalization given its scale.

**BASE MAP GENERALIZATION**
A base map distorting reference units to the point that absolute spatial calculations are impossible.

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*Image descriptions are not possible in text format.*
readers’ geographical imaginations, were merely biased. For example, highway maps and weather maps were excluded; though such maps may persuade the map reader to drive to a destination instead of cycling (see Wood and Fels 1992), or to bring an umbrella instead of sunglasses, they mostly deal with providing information based on a position, not with expressing persuasive arguments.

**TESTING THE RELATIONSHIPS**

For this study, analysis of the variables focused on answering two research questions dealing with the genealogy of persuasive maps: (1) How have persuasive map properties evolved through time? and (2) What properties of such maps have differed significantly depending on the publisher? In order to answer these questions, all of the coded variables were cross-tabulated with the two codes Map Era and Map Producer.

**Map Context Correlations with Era and Producer**

Only one context variable – Map Medium – proved to be significant when tested against Map Era and Map Producer.

Before World War I, persuasive maps were commonly printed independently from publications – as wall maps, postcards, or large sheets. During the first half of the twentieth century, news maps and other thematic representations were more regularly combined into atlases, which were often produced by national governments. The United Kingdom, Germany, and Spain each produced a variety of atlases during this period, often with a national theme (the United Kingdom glorifying the vitality of the Commonwealth (*Sixty Million of Us* 1944); Germany bemoaning its losses in World War I (*Springenschmid* 1935); and Spain showcasing the greatness of Imperial Spain in the past (*Menéndez Pidal* 1941) as the country recovered from a gruelling civil war. With the advent of the Cold War, persuasive cartography began turning up more regularly in newspapers, magazines, and other periodicals, disguised as objective reporting. During the Red Scare of the 1950s, the US government did not need to drive jingoistic rhetoric, as the press did it much more efficiently, regularly, and subliminally than a government atlas could. Since the end of the Cold War, map production has devolved even further. As the publication and news industries have come to compete with micro-publishers on the Internet, more and more print maps are being produced by individuals and nonprofit organizations for distribution online.

In the absence of editorial oversight, the room for persuasive cartographic manipulation is potentially much larger than it once was, as anyone with limited training and minimal ethical consideration can produce and distribute embellished information, if not outright disinformation.

<table>
<thead>
<tr>
<th>Table 1. Map medium by map era and map producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map Medium (%)</td>
</tr>
<tr>
<td>Map era</td>
</tr>
<tr>
<td>Pre-1915</td>
</tr>
<tr>
<td>1915–1945</td>
</tr>
<tr>
<td>1946–1989</td>
</tr>
<tr>
<td>Post-1989</td>
</tr>
<tr>
<td>Map medium</td>
</tr>
<tr>
<td>Government</td>
</tr>
<tr>
<td>Corporate</td>
</tr>
<tr>
<td>Non-Gov/Corp</td>
</tr>
</tbody>
</table>

The correlation between Map Medium and Map Producer shows this development even more pronouncedly than the correlation between Map Medium and Map Era (see Table 1). Now that network technologies have opened map-making to more types of producers, non-corporate and non-government map producers have begun to proliferate online.

**Data Models: Correlations with Era and Producer**

With the exception of one variable, correlations among data model manipulations differed between Map Era and Map Producer. Data-Source Availability on the map correlated with both Map Era and Map Producer. Only one other variable correlated with Map Era: inclusion of a publication date. Two additional data-model variables were tied to Map Producer: the identity of the publisher and inclusion of a map scale.

**DATA-SOURCE AVAILABILITY**

One of the simplest methods of data-model manipulation is to completely avoid displaying data sources on the map. It is far easier to make up data when you do not have to tell anyone where the data come from. Yet this tactic appears to be era specific (see Figure 3 below). A trend is clear. Prior to 1915, data sources were commonly referred to on maps; only during the first half of the twentieth century did producers of persuasive maps dispense with data sources altogether, and during the Cold War period, inclusion of data sources became prevalent again. Interestingly, this correlates with the rise of the quantitative revolution in the West and the fixation on science during the arms race with the Soviets; data sources are often used...
to assess scientific accuracy.) Since the Cold War ended, data sources have begun to fall by the wayside again. Before the Cold War era, maps were frequently produced by national governments to galvanize the public. The data could often be completely fabricated, as few members of the public had the capability to audit a government’s accuracy or truthfulness (a concern raised as compromising GIS as well: see, e.g., Taylor and Johnston 1995, 57–60). During the Cold War, however, newspapers, magazines, and periodicals began using maps more regularly; the news media pride themselves on editorial integrity and proper citation, and thus it comes as little surprise that journalists regularly list their data sources. Finally, it appears that as individuals and non-profit groups begin to create more maps to promote their causes, attention to accuracy and source information may be beginning to decline again.

Further analysis bore this out: when I tested Map Producer categories with the data-source variable, the relationship between the availability of the data source and the type of producer proved substantial (see Figure 2). News media and corporate producers were the most reliable when it came to citing the sources of their data (Figure 2). Non-government and non-corporate groups were second most attentive to this detail, and government-produced maps the least so. For purposes of persuasion, government maps typically omit the data source, conveniently allowing map readers to assume that the maps are based on “accurate” government data.

**Figure 2. Frequencies of Data-Source Availability by Map Era and Map Producer**

<table>
<thead>
<tr>
<th>Era</th>
<th>Available</th>
<th>Unavailable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-1914</td>
<td>37%</td>
<td>63%</td>
</tr>
<tr>
<td>1915-1945</td>
<td>16%</td>
<td>84%</td>
</tr>
<tr>
<td>1946-1989</td>
<td>64%</td>
<td>36%</td>
</tr>
<tr>
<td>1990-Present</td>
<td>52%</td>
<td>48%</td>
</tr>
<tr>
<td>Government</td>
<td>68%</td>
<td>32%</td>
</tr>
<tr>
<td>Corporate</td>
<td>43%</td>
<td>57%</td>
</tr>
<tr>
<td>Non-Gov/Corp</td>
<td>45%</td>
<td>55%</td>
</tr>
</tbody>
</table>

**AVAILABILITY OF MAP DATE AND ERA**

Most maps provide a date of publication or data acquisition, allowing a map reader to discern whether the map itself contains old data. Over the past several decades, however, provision of dates has become increasingly arbitrary (see Figure 3). Many persuasive maps created since the early 1990s are posted online and exist in near perpetuity – dateless and unyielding in the “facts” they are showing. Figure 3 illustrates that the trend appears to have become more pronounced with online maps. Though the Internet works as a cartographic tool that allows disenfranchised groups to create and distribute their own maps cheaply and quickly (Crampton 2009), it also seems to be facilitating cartographic manipulation.

**Figure 3. Map Date Availability by Map Era and Map Medium**

<table>
<thead>
<tr>
<th>Era</th>
<th>Available</th>
<th>Unavailable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-1915</td>
<td>79%</td>
<td>21%</td>
</tr>
<tr>
<td>1915-1945</td>
<td>79%</td>
<td>21%</td>
</tr>
<tr>
<td>1946-1989</td>
<td>86%</td>
<td>14%</td>
</tr>
<tr>
<td>Post-1989</td>
<td>61%</td>
<td>39%</td>
</tr>
<tr>
<td>Atlas/Book</td>
<td>76%</td>
<td>24%</td>
</tr>
<tr>
<td>Periodical</td>
<td>88%</td>
<td>12%</td>
</tr>
<tr>
<td>Other Print</td>
<td>73%</td>
<td>27%</td>
</tr>
<tr>
<td>Online</td>
<td>48%</td>
<td>52%</td>
</tr>
</tbody>
</table>

**CARTOGRAPHER/PUBLISHER AVAILABILITY AND PRODUCER**

Only rarely was the cartographer or producer of a map unacknowledged. By far the most likely producers to avoid putting their logo or name on a map were non-
government and non-corporate producers (28.3%), a marked difference from maps produced by corporations (only 3.6% failed to identify themselves) and maps by governments (only 7.3%).

**SCALE AVAILABILITY AND PRODUCER**

Among all producers except news media, it appears to be socially acceptable to omit scale from a persuasive map. Whereas corporate and mass-media producers omitted map scale 44.4% of the time, governments omitted it from 65.9% of their maps, while individuals, lobby groups, and NGOs omitted it 67.9% of the time.

**Graphic Manipulations: Correlations with Era and Producer**

Two graphic and visualization variables correlated with both Map Era and Map Producer – Illustrations and Inset Map inclusion. Only one other variable – Map Coloration – correlated with Map Era, while Map Producer correlated with two other variables: Map Labelling Style and Map Contrast Style.

**ILLUSTRATIONS AND SUPPLEMENTAL TEXT BOXES**

As shown in Figure 4, the use of Illustrations and of Text Boxes on persuasive maps were both significant by era. The use of text boxes on maps increased after World War II, whereas illustrations were used extensively on maps in the nineteenth and early twentieth centuries, decreased in popularity during the first half of the twentieth century, and have picked up again since. Overall, illustrations and/or textboxes appeared on 35% of the maps sampled.

A weaker relationship also existed between Map Producer and the use of illustrations (see Figure 4). Corporate and media maps more regularly employed at least one illustration adjacent to or over the mapped area (38.3% of these maps had accompanying illustrations); other producers were less likely to use illustrations, which appear on only 21.6% of government-produced maps and only 17.0% of those produced by NGOs, individuals, and lobby groups.

**INSET MAPS**

A majority of the maps in the sample were not accompanied by inset maps. Of those that were, in all eras except the first it was typical to have no more than two insets. The pre-1915 era was the least likely to include inset maps, which may be attributable to technological limitations in both production and printing.

A significant relationship was also found to exist between the map producer and the number of insets found on a map. Government maps were more likely to include inset maps (36.4%), and particularly to include more than two (see Figure 5); corporate and media maps, on the other hand, were more likely than government maps to include only one or two insets. Lobby groups, NGOs, and individual map producers in this sample did not regularly make use of inset maps: only six maps (11.3%) produced by this group included insets.

**COLOURING AND ERA**

The number and variety of colours found on persuasive maps has increased steadily over time. This is not surprising, given technological developments in both map creation and publishing over time, as well as the decreasing costs of printing in colour. In this sample, 90% of maps produced after 1989 were multi-coloured (96% used at least one colour in addition to grey), whereas before 1915 only 55% were multi-coloured (63% used at least one colour in addition to grey).

**LABELLING TYPE AND PRODUCER**

There was a significant relationship between producer and type of labelling. Most maps used standard labelling procedures, but media maps often used callouts (32.2%, vs. 11.3% for individual/NGO maps and 6.8% for government maps). This makes sense, as media maps (e.g., those published in newspapers) are often limited in the amount of colour they can use to differentiate labels. Regardless of map producer, halos around place names were rare.

**CONTRAST AND PRODUCER**

More than half of the maps in the sample contained at least one hue that contrasted with surrounding colours.
quite pronouncedly. Corporations and governments preferred to use red to establish stark contrast, while individual, NGO, and lobby-group maps most regularly used other colours (particularly yellow, orange, and purple). Government maps were the most likely to use a hue to establish contrast (71.6% of government maps established contrast using colour, compared to 45.3% of individual, NGO, and lobby-group maps and 40.9% of corporate maps).

Rhetorical and Layout Variables: Correlations with Era and Producer

Rhetorical and layout variables – determined based on Dondis (1973) – did not correlate at all with Map Era, and only two such variables correlated with Map Producer: Obliqueness of Perspective and Level of Contrast. Though the layout and design of persuasive maps have not changed significantly over time, the differences by Map Producer were significant.

**OBliqueness of Perspective and PRODUCER**

The angle and depth of perspective found on maps in this sample varied significantly depending on who produced the maps. Media groups were responsible for the largest proportion of oblique and three-dimensional maps found in the sample (77.3% of media maps). Further cross-tabulating these results by era revealed that this correlation has not changed over time. The media have typically offered perspectives that angle and spin the Earth so as to offer map readers an unconventional view of the data. Government maps, on the other hand, are much more restrained: aside from a brief period before and after World War II, when governments produced many oblique-angled maps, Western government agencies seem to have shied away from this technique. Interestingly, NGOs, individuals, and lobby groups use slightly oblique views more often than the other groups do (50.9% of the time), but very rarely go to the same extreme as media producers.

**EMBELLISHED CONTRAST**

The persuasive maps in this sample tended to be composed of extreme contrasts. Nearly as many maps scored at the maximum contrast ranking as scored in the lowest three ranks of contrast combined. Governments used contrast most regularly, followed by the media and corporations; non-government and non-corporate producers were least likely to make heavy use of contrast.

**Discussion**

The data discussed above demonstrate that as the science of cartography has evolved broadly, the tendencies and techniques of persuasive cartography have gone through their own unique transitions. Though the findings of this study are not as pronounced as some might have imagined, particularly given the evolution of cartographic technology (Crampton 2009; Monmonier 1985), the rise of “neo-cartography” (Turner 2006), and the ubiquity of online map mashups, there is evidence that persuasive cartography is changing more rapidly in the twenty-first
century. By and large, data-model manipulations have changed the most over time, while visual and layout manipulations have remained relatively consistent.

Of greatest significance is that data are increasingly being mapped without any source information to convey to the map reader the significance and reliability of what is being illustrated. Though this is not in itself a new technique for persuasive maps, its frequency has grown since the advent of the Internet. We can hypothesize that with online mapping quickly displacing paper maps, this trend will continue to speed up in general.

In the same vein, the lack of a production date on most contemporary maps is also interesting. Static maps represent a snapshot of a phenomenon; in the absence of a date, the map user cannot be sure when this snapshot was taken. As maps are increasingly distributed online and available for months or years at a time, the room for misinterpretation of a current phenomenon increases. This problem is compounded if the map gives no data source to begin with: dubious data may be represented as current in perpetuity.

In connection with the above two themes, the role of the Web in contemporary persuasive cartography cannot be overstated. The Internet has diffused the capability of persuasive map production to new producers. This de- volution of media, particularly since the advent of the Internet, is evident in society and politics at large, not only in cartography (Oas 2002). Once quite capable of curtailing media diffusion, states are rapidly losing their ability to control who has access to spatial data and the technology to produce maps. In the majority of cases, principled editorial oversight is no longer part of the map-production process. This represents a brave new world for persuasive cartography and for the role of maps as tools of rhetorical power.

To investigate such changes in the power of production, I also tested whether cartographic manipulations vary demonstrably by producer. Who produces a persuasive map was more indicative of what cartographic elements it would comprise than when the map was produced. Specifically determining why some of these correlations are so strong is beyond the scope of the present research, but some assumptions can be made, to be further tested in the future.

Within this sample, media organizations and corporations that made maps for mass consumption used data-model manipulation far less than other producers. This may have been because journalists and professional cartographers strive for a certain amount of scientific integrity, or at least of data legitimacy. The fact that data-model manipulation was less often used, however, does not mean that persuasive maps produced by the media and by corporations did not promote a particular argument. Like all the maps in this sample, these maps still comprised many graphic and layout variations. For example, though using data-model manipulation less regularly, media maps typically offer engaging perspectives (i.e., oblique instead of two-dimensional) and are far more likely to be illustrated than other types of maps. Government maps serve a variety of purposes; they can be used to inform audiences of policy decisions, persuade opponents to perceive a conflict in a particular way, or reinforce constituents’ already entrenched beliefs. Nonetheless, several techniques shone through in government-produced maps within the study sample. Data-model manipulation was found far more regularly on government-produced maps than on those produced by others. Data sources were most often missing from government maps, which is somewhat odd given the extent of the data sources most governments have at their disposal. Scale bars were more frequently omitted by governments than by the media or corporations. Government maps were also more likely to be part of a series of maps, rather than one-time representations; this makes sense in many ways, as commercial and media periodicals often use specific maps to help readers understand current events or stories. On the graphics side, government maps were more likely to employ high levels of contrast.

The most unpredictable map producers were independent, non-profit, and lobby-group cartographers. The maps these groups and individuals produced were frequently outliers in the sample. In part, this likely has to do with the fact that the intended audiences for these maps were all unique and frequently changing. Traditionally, governments tend to have a continual and predictable national audience, while media maps are often created to be used as content supplements for particular audiences. Further research on non-government and non-corporate persuasive cartography specifically may shed further light on why such maps are unique.

Conclusion

Given the initial analysis above, what conclusions can be drawn about the genealogy of persuasive cartography? Do Map Era and Map Producer operate as indicators as to what techniques are likely to be employed in the creation of such maps? Furthermore, how robust might quantitative content analysis be for further analysis of persuasive cartography and of cartographic history more broadly?

With respect to whether persuasive cartographic techniques and trends have evolved over time and changed depending on different geopolitical contexts, the answer is yes—but only slightly. In this sample, at least, the techniques used on persuasive maps have certainly not changed in a linear manner, and most variables have not changed significantly at all. Statistically speaking, however, there have been temporal shifts that correlate with geopolitical episodes; for example, the amount of colour
used to establish dramatic contrast on persuasive maps has paralleled the advancement of cartographic technology. Moreover, as more people have become able to produce and distribute maps since the proliferation of Internet access beginning in 1994, we see that data-model manipulation has become particularly common among non-profits, individuals, and lobby groups making their own maps. Whether or not this is due to a lack of cartographic training is irrelevant; the point is that there has been more opportunity for misrepresentation and less editorial oversight when it comes to data-model manipulation.

Persuasive cartographic manipulations change more noticeably by map producer than by era. Different producers and publishers have typically used different types of cartographic techniques. Government maps tended to use more contrast and data-model ambiguity; maps produced by the media were more likely to use oblique angles and illustrations.

In many ways, the level of similarity in the cartographic techniques used by producers was more informative than the differences as to the nature of persuasive maps. All types of producers regularly used emotive symbols (e.g., mimetic, non-geometric shapes), and dynamic maps illustrating motion and movement were produced at the same high rate by all types of producers. Base map and data generalizations were not producer specific, and the various producers used most of the mapping techniques with similar regularity.

Thus, although differences exist, the mapping techniques and layout designs found in the persuasive maps in this sample are remarkably consistent across eras and producers. These findings imply that certain techniques are frequently embraced in creating persuasive cartography in the Western context. Such consistency might have been missed, or dismissed as anomaly, in broader historical studies of trends in cartography as a whole; now these unyielding characteristics can be understood as an integral part of the genealogy of persuasive mapping.

The next step will be to test how different cartographic techniques correlate with one another. For example, do persuasive maps that omit legends more frequently include illustrations? Do maps that use emotive symbols more regularly leave off a map legend? Using QCA, such questions with respect to this data set can be not only asked but answered. These questions go beyond the scope of this research, however.

A secondary motive for this research was to test QCA as a viable method for the longitudinal analysis of large data sets of maps. QCA may prove extremely useful in future research dealing with the study of idiosyncratic map genealogies. Once research questions are asked, codes developed, and a sample collected, one can begin to analyse large numbers of maps quickly. It should be noted that “quickly” is a relative term: the average time required to analyse each map was around one hour. Still, compared with many other methods, which often require hours of analysis per map, these 256 maps were coded in a timely fashion.

This article represents a beginning, not an end. Though QCA has shown itself useful for exploring the genealogy of persuasive cartography, I believe that it can be applied to the longitudinal study and comparison of nearly all maps. Because of the amount of literature and the extent of the debate over defining persuasive maps and how they are constructed, this sample proved an inspiring first case study. I foresee that QCA will prove equally effective in the study of less politically charged cartographic specimens, such as cultural differences in cartographic representation, the historical evolution of symbology on weather maps in the United States, or historical shifts in thematic representation of certain places over time (e.g., in Goode’s World Atlas or in maps by the National Geographic Society). This method would be effective for any type of research that requires making comparisons across many maps at once.

Indeed, it is to be hoped that future QCA of maps will avoid several of the limitations that confronted this research: First, because this was not a random sample, the results cannot be directly generalized to persuasive maps broadly. Though the sample size is large, and I believe that further research on similar maps will provide further evidence for the results described here, the sample was selective and does not represent all types of persuasive maps. Second, although one of the main benefits of QCA is its replicability, in the case of this research I had no assistant to separately code a sub-sample of my maps to check for replicability. I did test for the reliability of my own coding by revisiting previously coded maps several weeks later and recoding them (only one of 50 such recoded maps proved problematic; this map was subsequently omitted from the study); until this research is proven replicable, however, it should be treated as an exploratory foray. (In the interests of transparency, this study’s data have been posted online so that others can double-check and reuse the coding if they see fit. The data are available here: http://www.ian.muehlenhaus.com/professional.)

This article begins to explore the genealogy of persuasive cartography, illustrating that certain longitudinal and evolutionary questions about this genealogy can be answered using content analysis. By breaking down 256 persuasive maps into 192 context, data-model, graphic, and layout variables, the most dynamic characteristics of such maps are highlighted, illustrating how these rhetorical tools of communication have changed in construction over time and by producer.
References


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