The Illusory Nature of Maps: Peeling Back the Layers

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EES120 – Principles of Sustainability Science – Spring2011, Furman University, Greenville, SC

I. Introduction

Maps are versatile. They have several roles and functions and can be used in various applications, for example, as art, protest, commentary, in development, defense, advertising and in disinformation. Maps have become more readily accessible particularly due to open-source web-mapping programs. However, care must be taken in producing, distributing, reading and using maps, as they may be produced by amateurs who are unfamiliar with mapping techniques, or by those who intend to mislead or misinform. Lastly, a map is one in a series of representations that may be produced for the same data, depending on the choice of methods of classification, normalization and other modes of representation and display.

The purpose of this project is to draw attention to the versatility of maps as well as the care that must be taken in interpreting maps within their proper context. In order to accomplish the goals of this project, maps will be created using applicant data to Furman University, for cohorts 2007-2010.

II. Literature Review

Early maps

i) Twelfth- and thirteenth-century Song China (De Weerdt, 2009):

- Maps were contemplative in nature and viewing was restricted to individuals, usually rulers/emperors. For example, the map of the first empire was enclosed in a mausoleum and buried with the founder of the empire so that no one else could view the map.
- Poems and letter show that maps were tied to ideas of home and elicited feelings of sorrow at loss of territory.
- With the advent of printing, the role of maps shifted from contemplative to practical and the symbolic power shifted to a broader audience of literate elites.

i) Maps of the Renaissance and Counter Reformation periods, Italy (Fiorani, 2005):

- Maps in the court of Duke Cosimo I de'Medici (1537-74) and the papal court of Gregory XIII Boncompagni (1572-85).
- Viewing of maps was restricted to the Medici and papal courtiers and visitors.
- Maps were used for administration and defense of the state, collection and distribution of resources, as visual aids in reading the Bible and the classics, and in understanding reports on European wars.
- Maps were monumental in size and housed in large rooms. The views of the maps were as if on the inner side of the globe, rather than the outer side.
- Maps were indexical, iconic and symbolic: a cartographic grid served as a point of reference for sites on the earth and on the map; perspectival views of mountains, cities and people added qualitative and descriptive dimensions.
- The act of walking through the architectural spaces in which maps were displayed served to make concrete the mental walking through 2-D maps in which territory is represented by imagining oneself walking through mountains, roads and places, as one's finger or eyes move over the surface of the map.

Modern Maps

Web maps: Case-study of Google's Map Maker (Boulton, 2010):

- Increase the ease of access to and authorship of maps- 'the plebiscization of a once noble art form'.
- Users are ranked and user's contributions are added to the map database on the basis of users' hierarchy in the community. Then, maps are readily available for use.
- Care must be taken in producing, distributing and interpreting maps.

Lying with Maps (Monmonier, 1996):

- A map is one in an infinite number of maps that can be produced for the same data.
- Map elements and classification can be varied to produce different effects.
- Maps may be used for different purposes: as advertisements, political tools, and in development, defense and disinformation.
- The following quote from Monmonier captures the essence of "lying with maps":

> "A good map tells a multitude of little white lies; it suppresses truth to help the user see what needs to be seen. Reality is three-dimensional, rich in detail, and far to factual to allow a complete yet uncluttered two-dimensional graphic scale model. Indeed, a map that did not generalize would be useless" (p.25).

Role of maps- performative, participatory, political (Crampton, 2009):

- Maps are works of cultural performativity: the role of maps can change.
- Maps as art, protest and commentary.
- There is a need for a revitalization of the mapping practice, focusing less on ontology (how things are) and more on ontogenesis (how things become) in order to use maps to creatively tell spatial stories.

III. Methodology

- **Dataset**: Applicant and enrolled data (17438 records) for Furman University, cohorts 2007 to 2010, where the 2007 cohort is defined as students intending to enroll in 2007. Data fields include "Student Status" (Enrolled/Applicant), "Entry Term" (Cohort 2007-2010), "State", "ZIP code", "Country", "Gender" (Male/Female) and "Ethnicity".
- **Recoding**: Student home location data is defined by state and ZIP code for students residing in the Unites States of America (US), and by country for students who are non-US residents. Zip Code data was cleaned-up in Excel, to 5-digits. For international students, "State" was recoded from "(blank) to "XX" and "Zip Code" was recoded from "(blank)" to "00000"; International locations are therefore less precise than US locations. Geocoding was successful, except for 42 points, whose states were "AE", "AA" or "AP", which are Armed Forces Africa, America and Pacific, respectively.

Map 1. Home locations for applicants and enrolled students at Furman University.

- Data for all four cohorts are plotted as points, with yellow dots representing home locations for applicants (who either did not enroll or were not accepted) and red dots representing applicants that enrolled.
- Projection is the Robinson projection (Fig. 1).

Map 2. International Students Enrolled at Furman University.

- Frequency of enrolled international students is shown. "0" is plotted for countries from which students applied but did not enroll.

Maps 3 and 4. Enrolled international students as a percentage of international applicants.

- Map 3 uses natural breaks classification with 5 classes, and map 4 uses quantile classification with 8 classes.
- International enrollment data is normalized with international applicant data.

Map 5. Enrolled students per state .

- Choropleth map : natural breaks (Jenks) with 5 classes.

Map 6 and 7. Enrolled students as a percent of applicants, per state.

- Map 6 uses natural breaks and map 7 uses quantile classification, both with 5 classes.
- US enrollment data is normalized with US applicant data.

V. Discussion

Map 1, while it is all-inclusive, is not very useful. The data is cluttered for North America, while data for other countries are sparse and difficult to interpret. Maps 2 to 7 attempt to generalize data so that it can more easily be read and utilized.

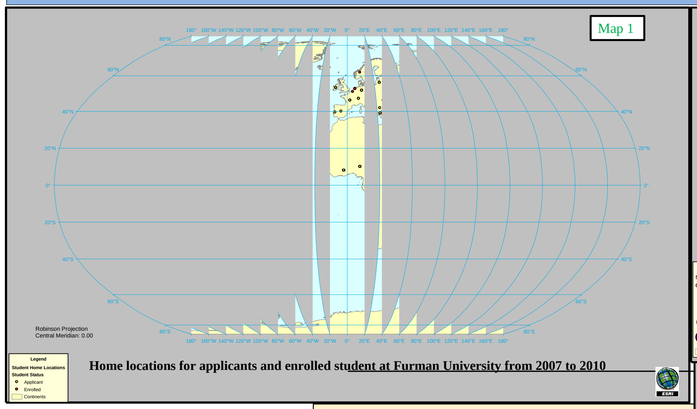
Data here are represented in two different ways, as choropleth maps for the US, and as graduated symbols for non-US countries. Choropleth maps were chosen as they make quantitative trends per state more easily discernible. Graduated symbols were chosen to highlight frequency differences for point locations. Different classification methods were employed to further qualify the data.

Map 2, which shows enrolled international students, may suggest to the reader that high frequencies of international students enroll at Furman. However, this picture must be interpreted within a broader context. We should first consider that international applicants constitute only 4.19% of all applicants. For further analysis, enrolled international students were normalized as a percentage of international applicants, as is represented in maps 3 and 4. The respective histograms are displayed in Fig. 2. Changing from natural breaks to quantile classification with the same number of classes only slightly altered the visual representation. In map 4, increasing the number of classes for quantile classification increased the number of categories of data and makes the distribution of data look slightly more homogenous than in map 3. Changing type of classification and number of classes for the small dataset produces subtle differences that may be useful for masking trends.

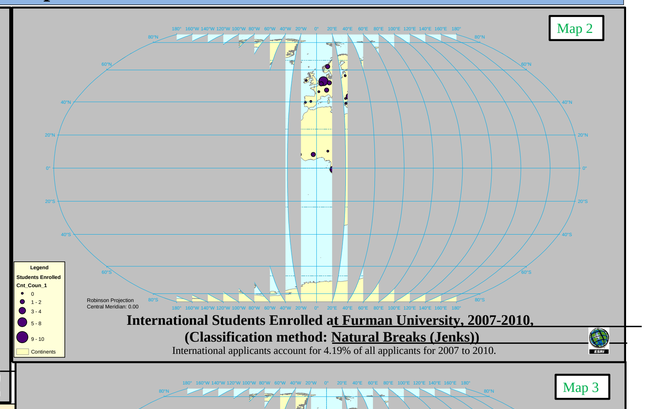
Maps 5 to 7 are for US residents. Map 5 shows numbers of enrolled students per state, and maps 6 and 7 attempt to add greater context to this data, by normalizing enrolled students as a percentage of applicants from that state. Different classification methods are used in maps 6 and 7 and the respective histograms are displayed in Fig. 3. Even though the same number of classes was used, the visual difference created by changing classification method with the choropleth maps is more apparent than the same change with graduated symbols.

Quantile classification is useful as it groups data into relatively even groups. Natural breaks groups data values with similar trends. One should pay attention to histograms when they are displayed with data, as aids to unraveling the truth behind the representation.

IV. Results- Maps



Home locations for applicants and enrolled student at Furman University from 2007 to 2010



International Students Enrolled at Furman University, 2007-2010, (Classification method: Natural Breaks (Jenks))

International applicants account for 4.19% of all applicants for 2007 to 2010.

Figures

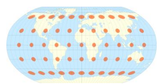


Fig. 1. Robinson projection with Tissot's Indicatrix of deformation (Wikipedia, 2011)

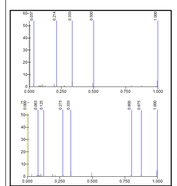


Fig. 2. Histograms for graduated symbols maps. **Top:** Map 3, natural breaks classification with 5 classes. **Bottom:** Map 4, quantile classification with 8 classes.

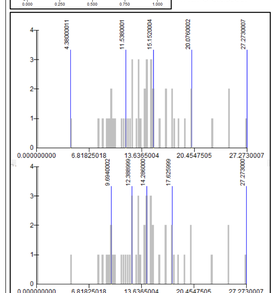
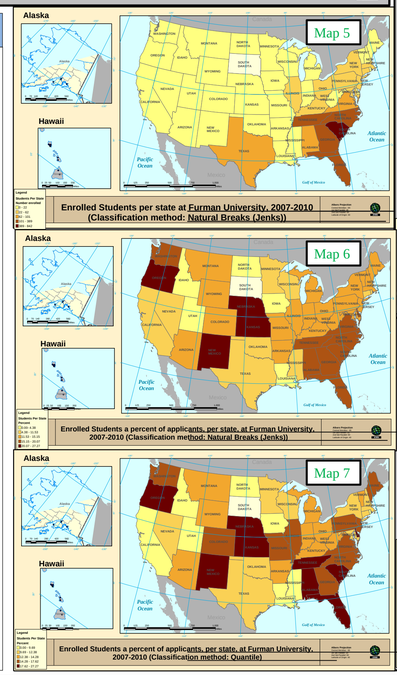


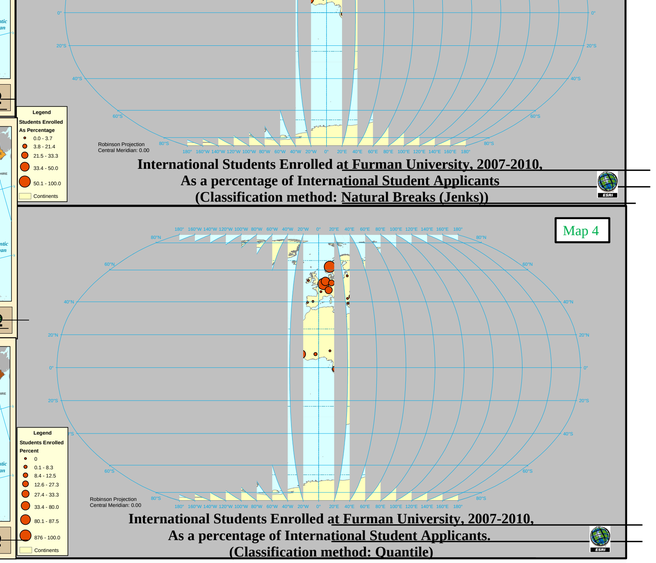
Fig. 3. Histograms for choropleth maps, both with 5 classes. **Top:** Maps 6, natural breaks classification. **Bottom:** Map 7, quantile classification.



Enrolled Students per state at Furman University, 2007-2010 (Classification method: Natural Breaks (Jenks))

Enrolled Students a percent of applicants, per state, at Furman University, 2007-2010 (Classification method: Natural Breaks (Jenks))

Enrolled Students a percent of applicants, per state, at Furman University, 2007-2010 (Classification method: Quantile)



International Students Enrolled at Furman University, 2007-2010, As a percentage of International Student Applicants (Classification method: Natural Breaks (Jenks))

International Students Enrolled at Furman University, 2007-2010, As a percentage of International Student Applicants, (Classification method: Quantile)

VI. Summary

- There is more to maps than meets the eye. Maps are versatile and can easily mislead or misinform.
- One may "lie with maps" by varying style of data representation, and classification methods.
- Use histograms as aids in interpreting data.

VIII. Acknowledgements

Dr. Amelie Davis and Professor Mike Winiski assisted in making these maps. Professor Winiski suggested Monmonier's book, which served as the inspiration for this project. Planning and Institutional Research provided the dataset which allowed me the enjoyment of practising "lying with maps".

VII. References

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