Maps and Map Analysis I

GEOG380 FA 2018

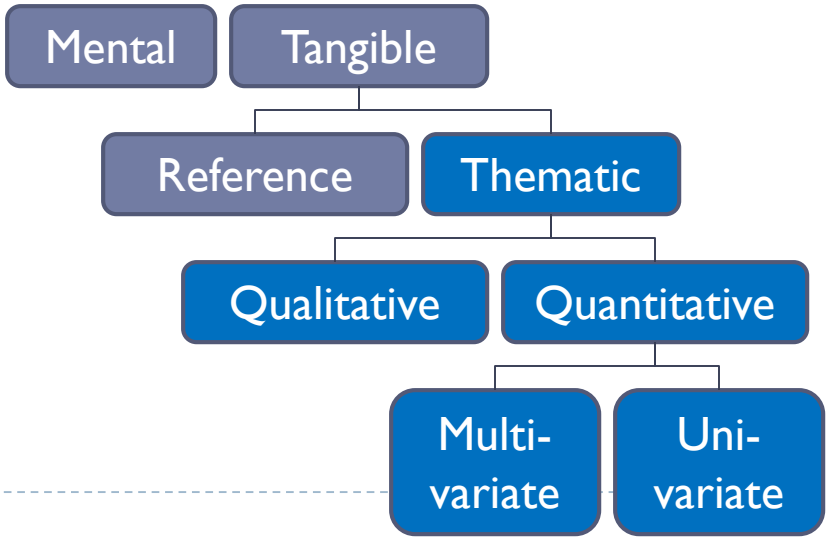
Outline

- Maps and map use
  - Types of maps
  - Map communication
  - Thematic representation using maps
- Example analysis methods frequently used in maps
  - Bivariate mapping

Revisit: maps and map-use

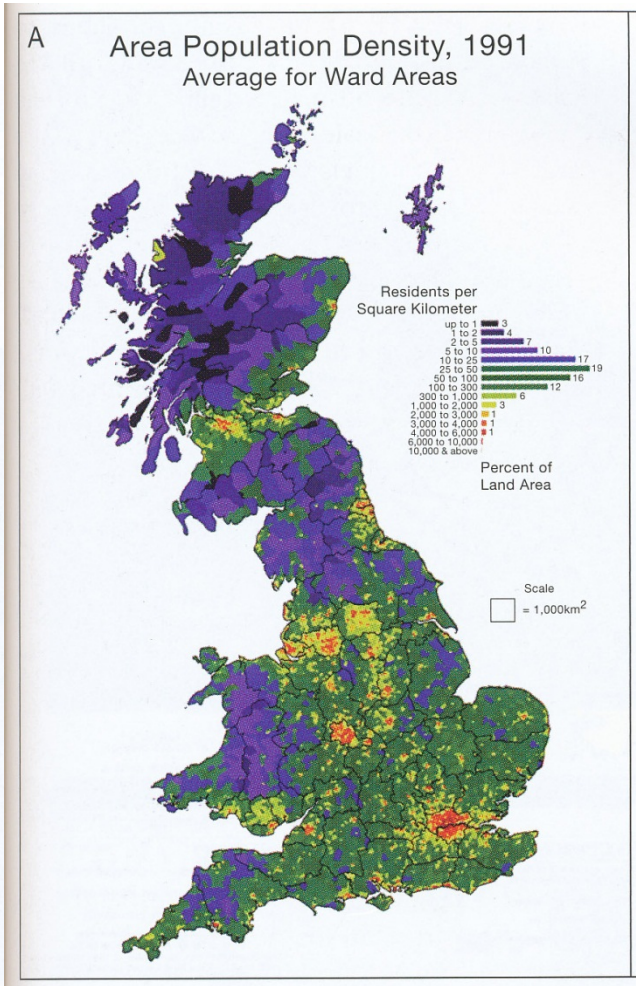
- Maps are important tools for communication and decision support
  - Warfare, territorial administration, defense…
  - Economic, environmental, social activities…

- Revisit types of maps
  - General reference maps
  - Thematic maps
  - Charts
  - Concept maps, mental maps



Exercise

- Flip through your textbook (Slocum et al. 2009) or search the internet and identify one example for each of:
  - Thematic map
  - General reference map



COLOR PLATE 19.1 Maps of population density
The equivalent projection suggests that most of Br
greens), whereas the cartogram provides a detailed
Dorling 1995a, p. xxxiii. Courtesy of Daniel Dorling.)

(Source: Slocum et al. 2009)

One definition of Cartography

- *"Cartography is the art, science, and technology of making maps together with their study as scientific documents and works of art. In this context may be regarded as including all types of maps, plans, charts, sections, three-dimensional models, and globes representing the earth or any celestial body at any scale."*

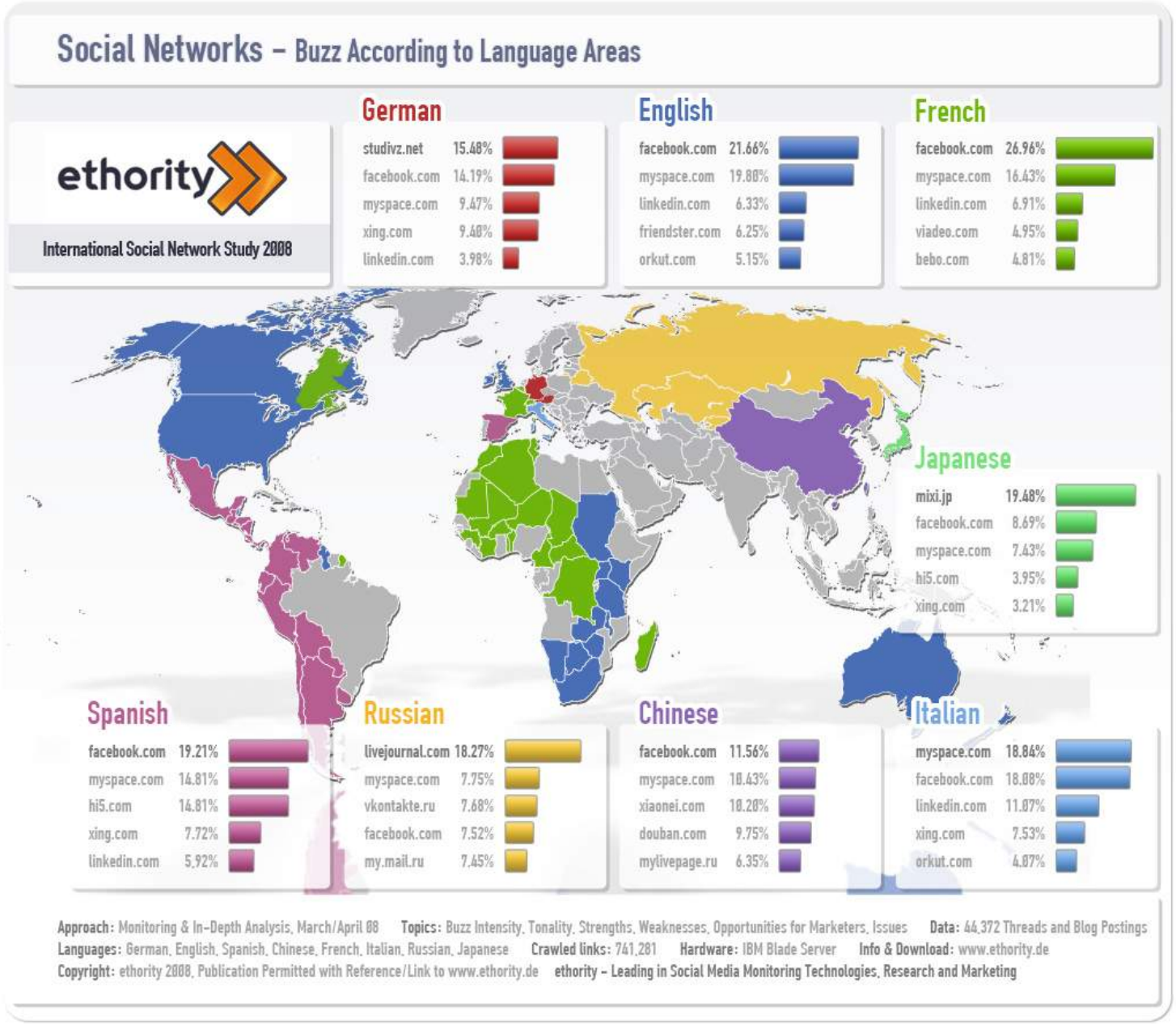
  (The International Cartographic Association)

Why study Cartography?

- "In short, maps and other graphics comprise one of three major modes of communication, together with words and numbers. Because of the distinctive subject matter of geography, the language of maps is the distinctive language of geography. Hence sophistication in map reading and composition, and ability to translate between the languages of maps, words and numbers are fundamental to the study and practice of geography"

  (John Borchert)

(Source: Ban and Ahlqvist 2009)



source: http://www.databison.com/wp-content/uploads/2008/09/international_social_network_study.jpg

Geographer & Cartographer

- As a geographer you need maps to…
  - Find location of things
  - Look for spatial/temporal pattern(s)
  - Compare patterns across maps
  - More about analysis
- As a cartographer you need maps to…
  - Gather information
  - Organize information
  - Communicate (represent) information
  - More about visualization

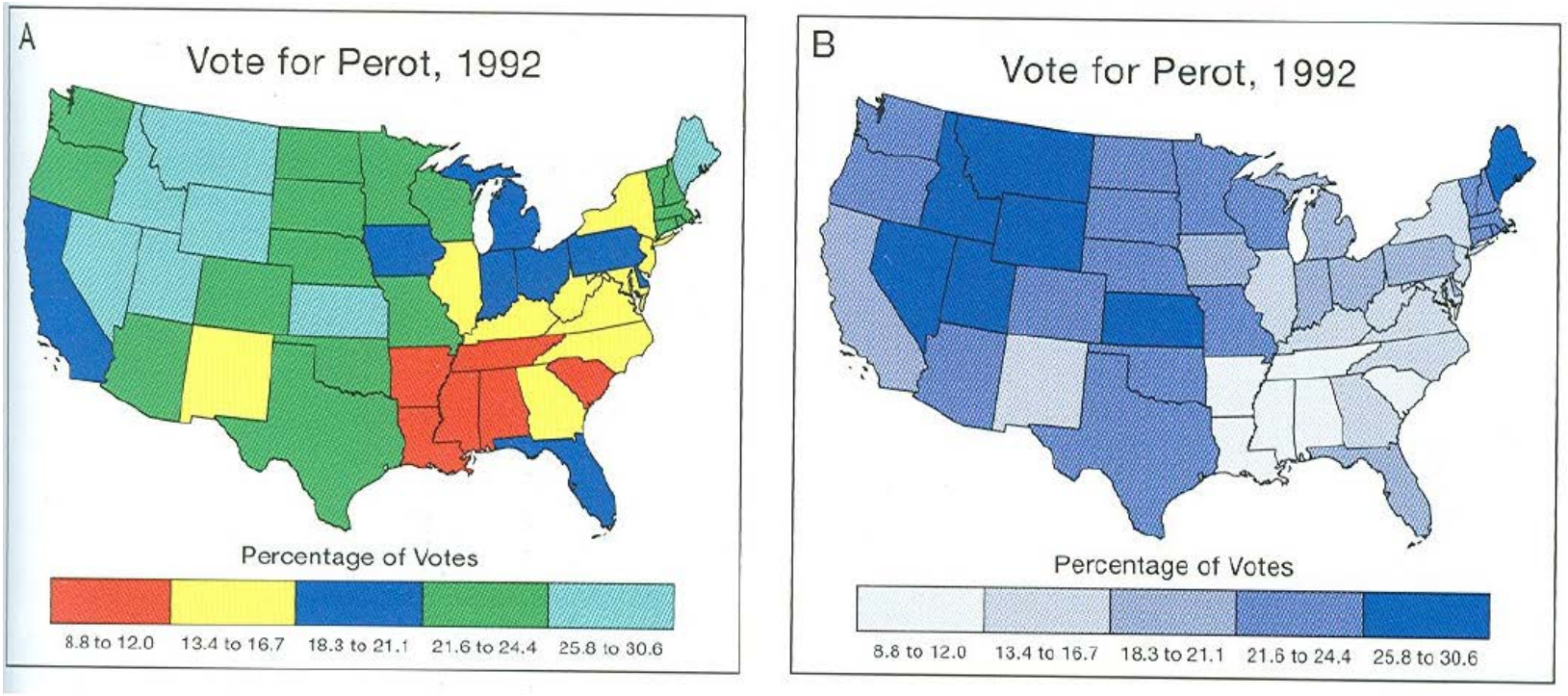
+

=

(source: http://www.persistenceunlimited.com/2007/10/leonardo-da-vincis-health-tips/)

More reasons…

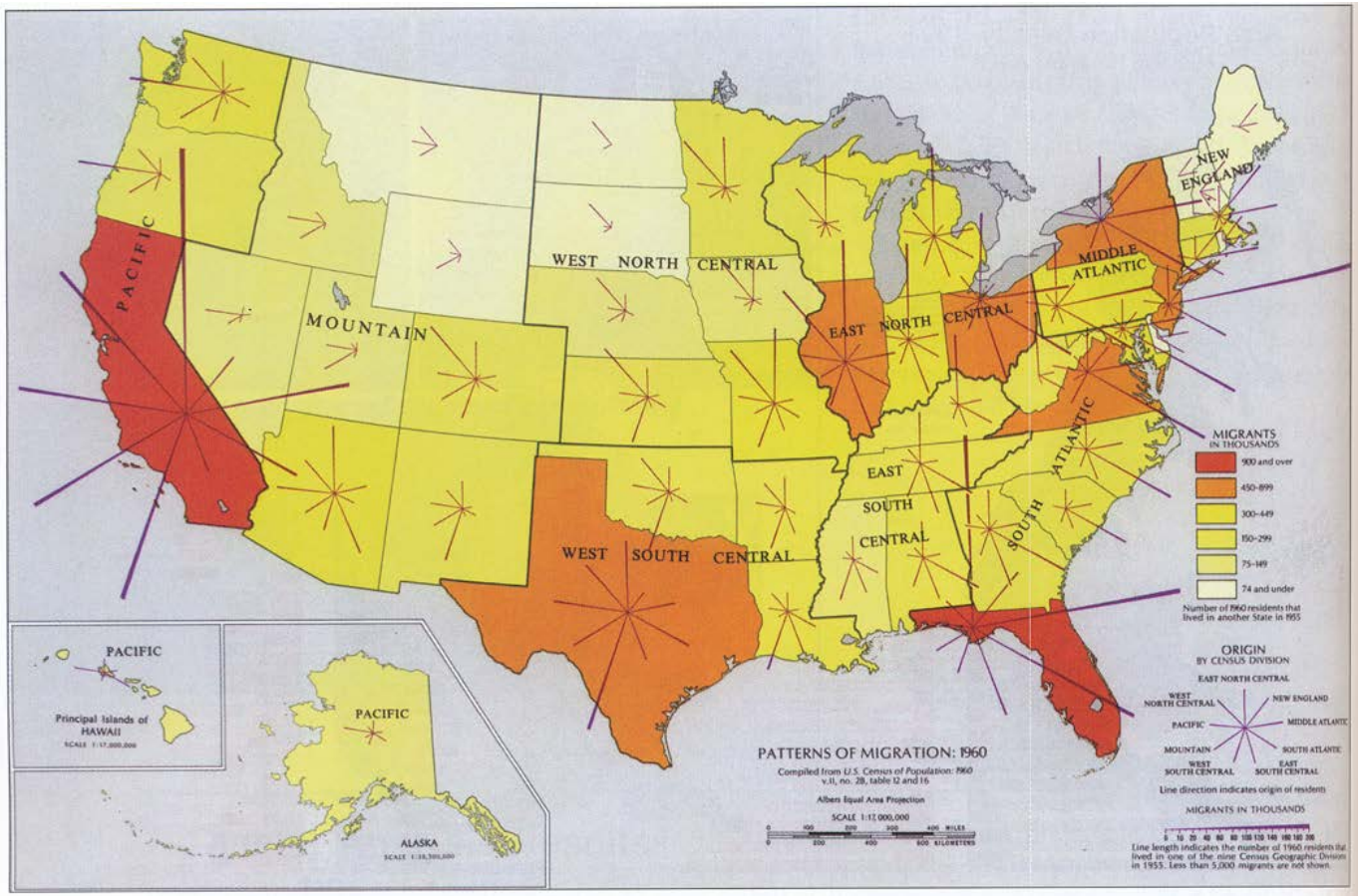
- To avoid some major pitfalls, we need to…
  - Read and interpret maps
  - Design maps



(Source: Slocum et al. (2009), Color plate 1.1)

Group Exercise (5 min.)

- What state(s) has(have) *the largest migrants*?
- What *variable(s)* do you see?
- What do you think explains *the differences* between the states?
- What other information would be helpful to *compare* between states?

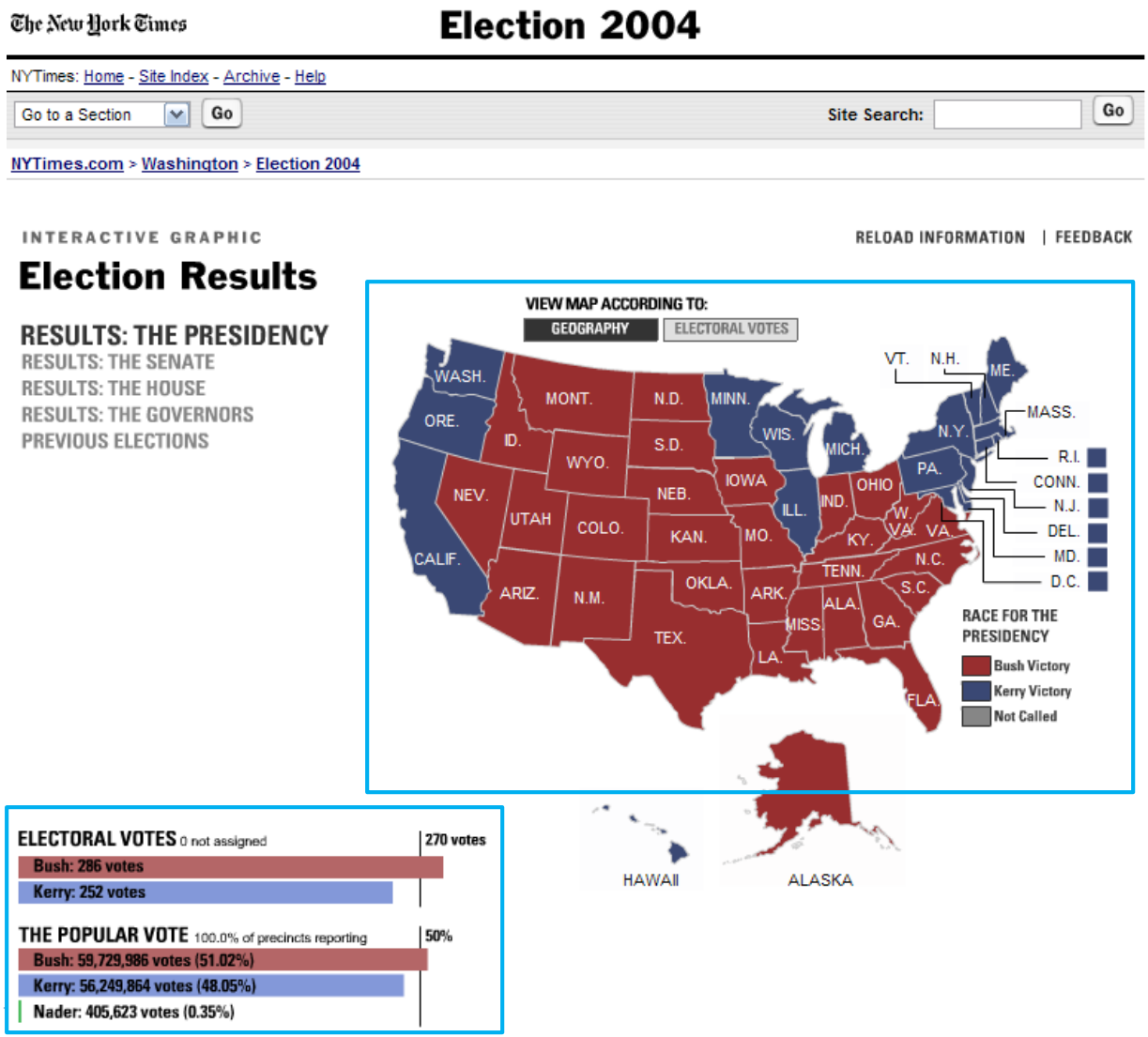


COLOR PLATE 19.3 A radial flow map that depicts the quantity of migrants from various regions of the United States to each state; choropleth shading depicts the total number of migrants to each state. (Source: U.S. Geological Survey (1970).)

(Source: Slocum et al. 2009)

More examples

- The presidential election in 2004 (NY-Times)
  - Compare what you see from the map content and the graphic bars below
    - Do they look similar or not?



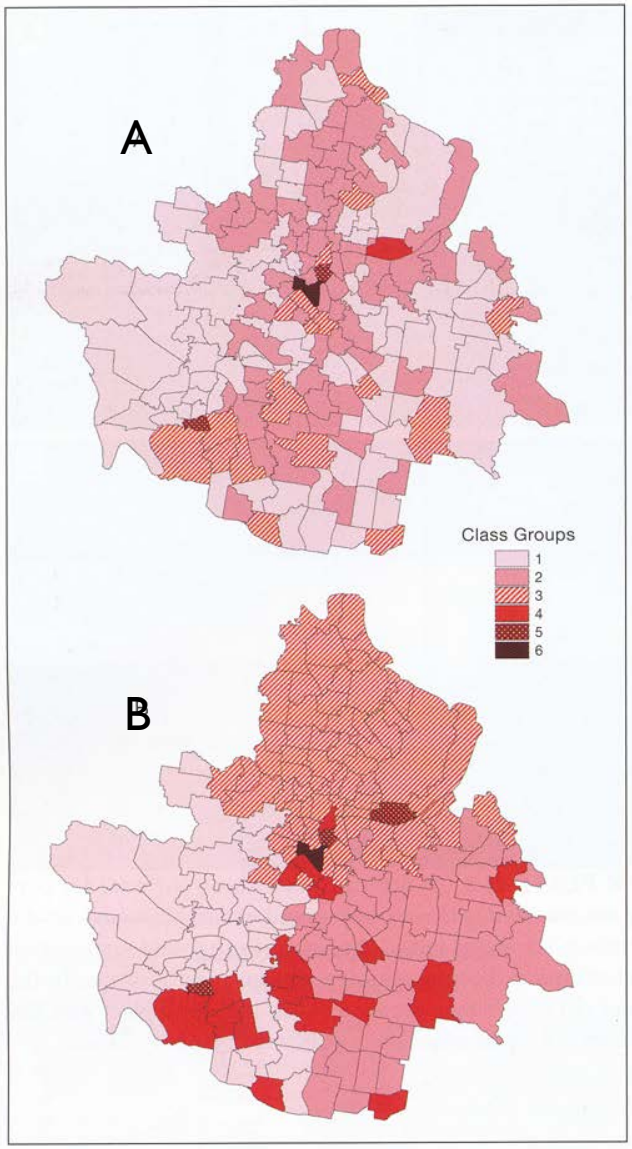
(source: http://www.nytimes.com/packages/html/politics/2004_ELECTIONRESULTS_GRAPHIC/)

Effect of data handling using weights

- Crime areas using crime rates & distance *weighted*

Crime	Distance
A: 1.0,	0.25
B: 1.0,	**0.95**

- See the effects of the weighted variable



COLOR PLATE 26.5 Two maps resulting from applying Murray and Shyy's median clustering method: (A) weights of 1.0 and 0.25 are assigned to crime rates and distance, respectively; (B) weights of 1.0 and 0.95 are assigned to crime rates and distance, respectively. (An adaptation of Figures 4 and 5 from Murray and Shyy (2000) "Integrating attribute and space characteristics in choropleth display and spatial data mining." *International Journal of Geographical Information Science* 14(7), pp. 649–667; courtesy of Taylor & Francis Ltd., *http://www.tandf.co.uk/journals.*)

(Source: Slocum et al. 2009)

Revisit: A primer on cartographic design

Step 1
Consider what the real-world distribution of the phenomenon might look like

Step 2
Determine the purpose of the map and its intended audience

Step 3
Collect data appropriate for the map's purpose

Step 4
Design and construct the map

Step 5
Determine whether users find the map useful and informative

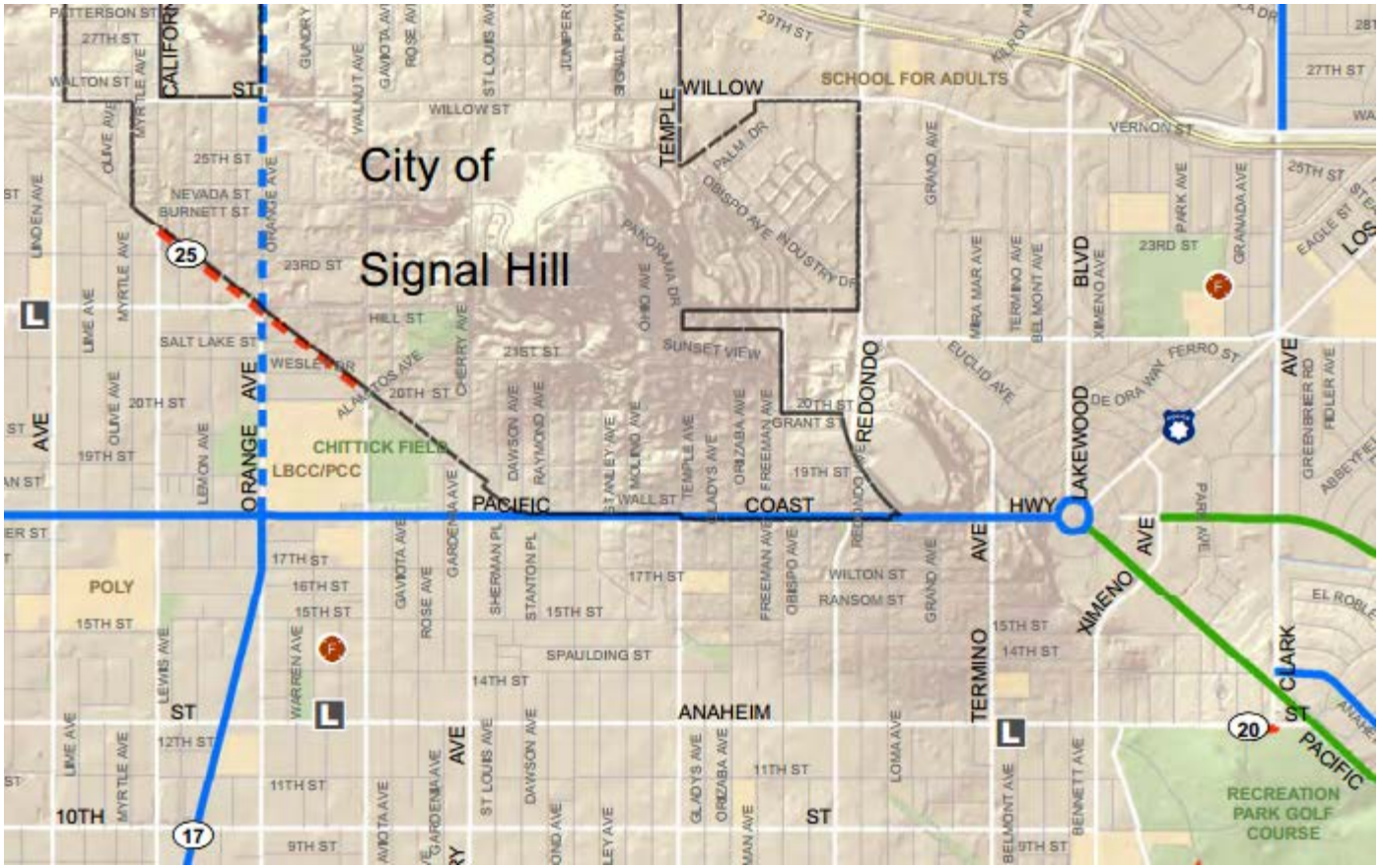
Step 1. What does the phenomena look like?

- For example, bike routes in Long Beach, CA
- …and some points of interest (POI) within the area

(source: http://www.bikelongbeach.org/Downloads/BikeMapLrg.pdf)

Step 2. What is the map purpose and targeted audience?

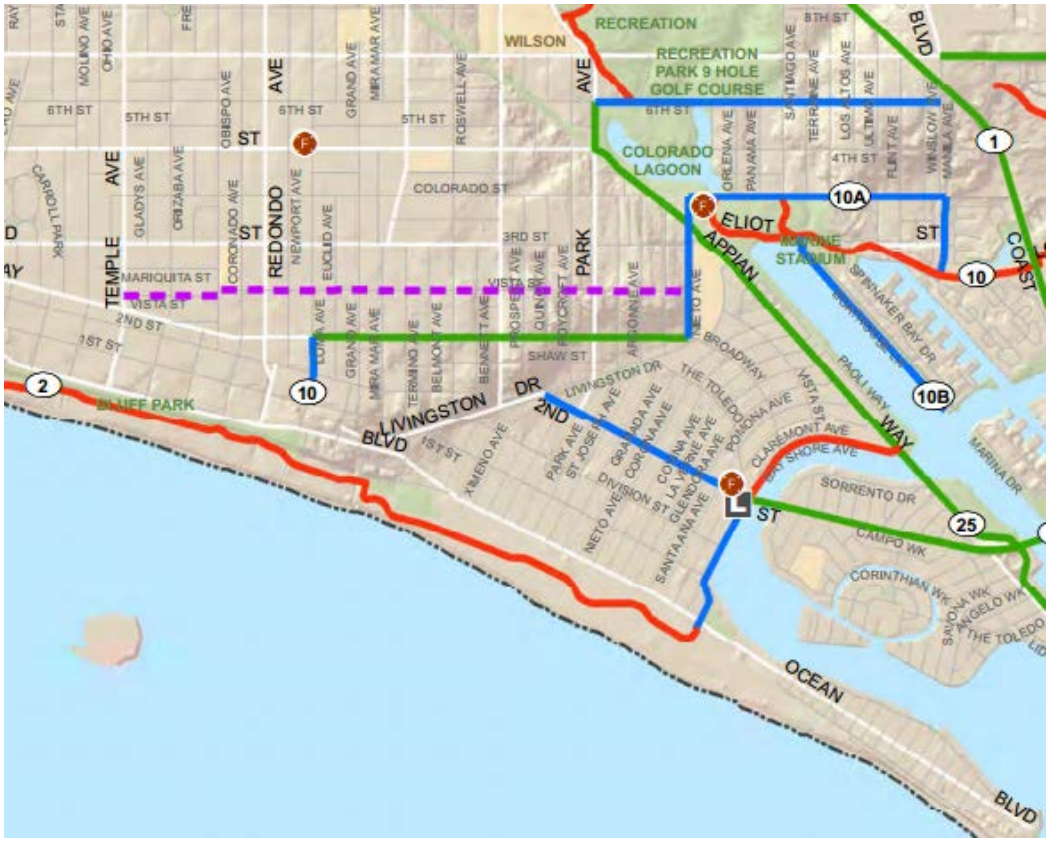
- General tourists
- Bike tourists



(source: http://www.bikelongbeach.org/Downloads/BikeMapLrg.pdf)

Step 3. Data collection

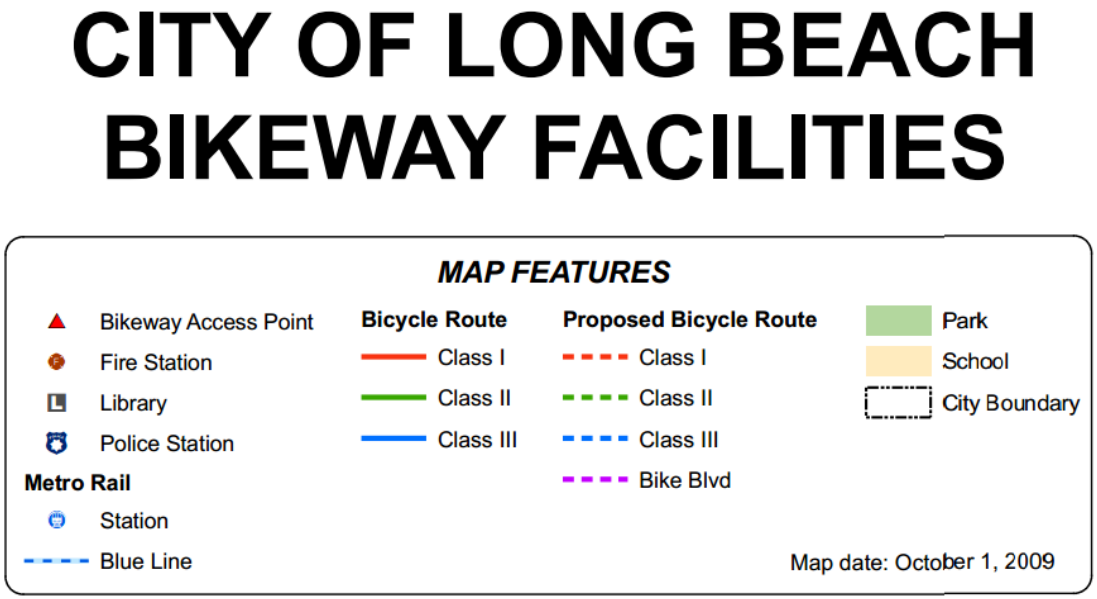
- Existing data of tourist destinations, bike routes, bike shops, …
- General reference maps
- Survey if necessary
- Etc.



(source: http://www.bikelongbeach.org/Downloads/BikeMapLrg.pdf)

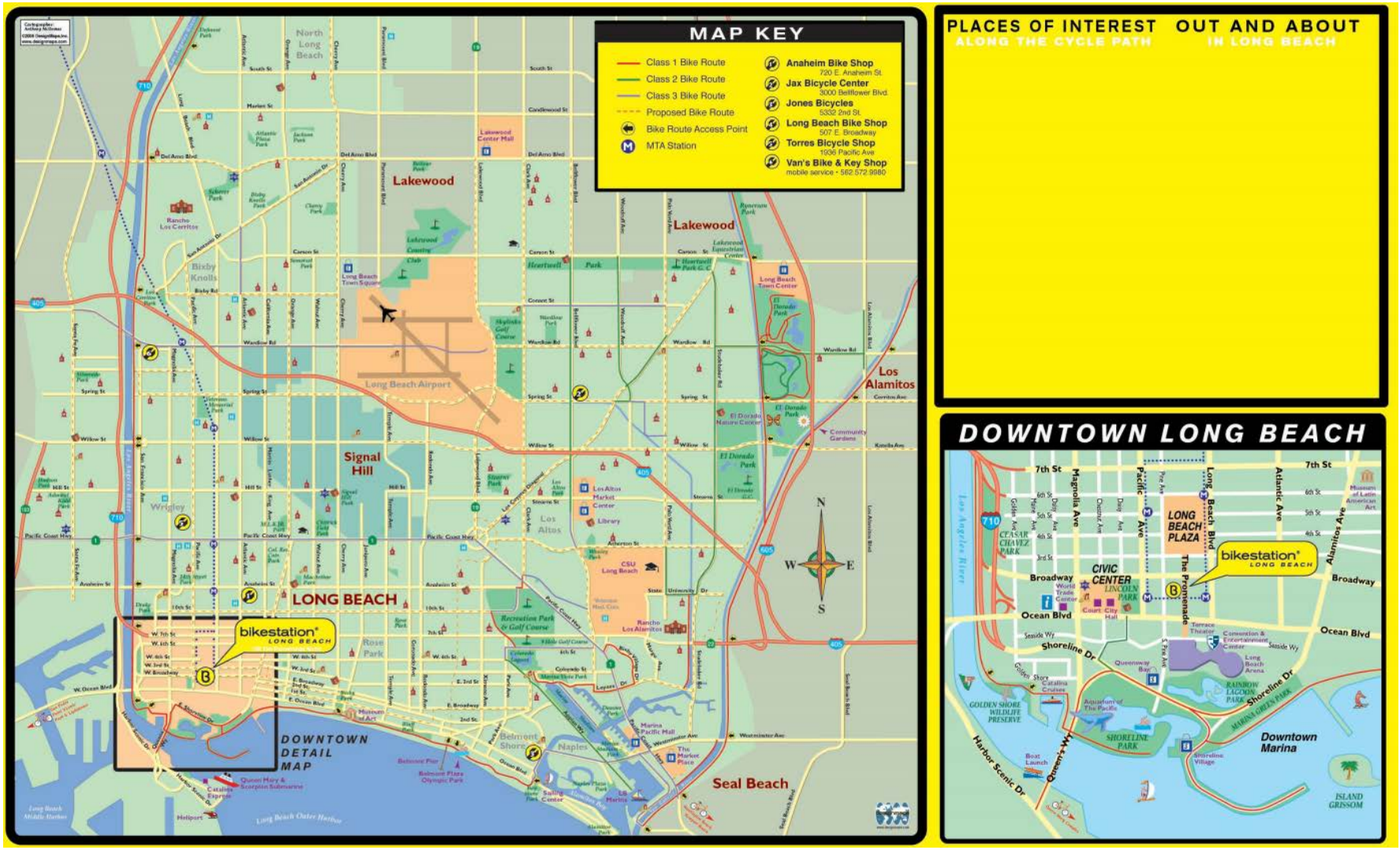
Step 4. Map design and construction

- Questions to ask
  - Type of media
  - Spatial dimensions
  - Measurement type
  - How many attributes (variables)
  - Temporal component
  - Technical limits
  - Intended audience
  - Time and budget
- Examples
  - Map size, cost or price, area selection, data generalization, symbolization…



(source: http://www.bikelongbeach.org/Downloads/BikeMapLrg.pdf)

Other style…



Source: http://mappery.com/map-of/Bike-Routes-Long-Beach-California-Map

Step 5. Evaluation

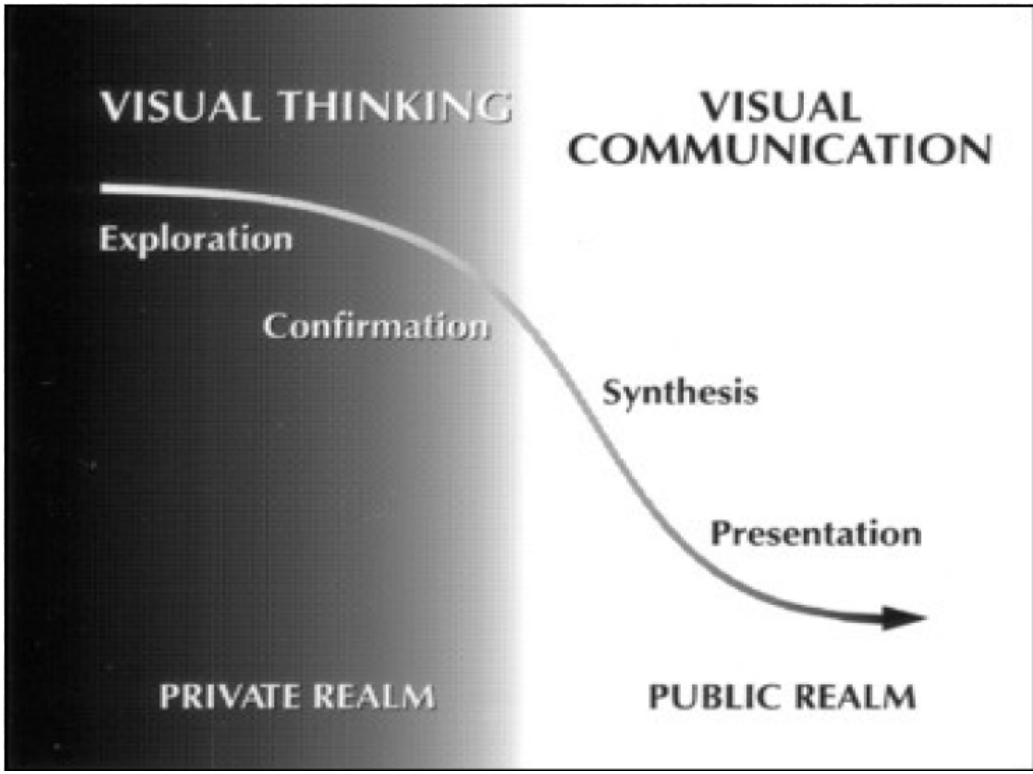
- Survey, field study, etc.

(source: PressTelegram, article on 05/06/2009)

Ways of Using Maps for Thematic Representation

- The use of visual representations flows through the process of visual thinking and visual communication with respect to realms of private and public during an idealized research sequence

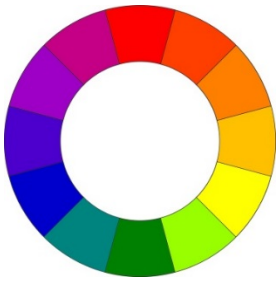
  (DiBiase 1990)



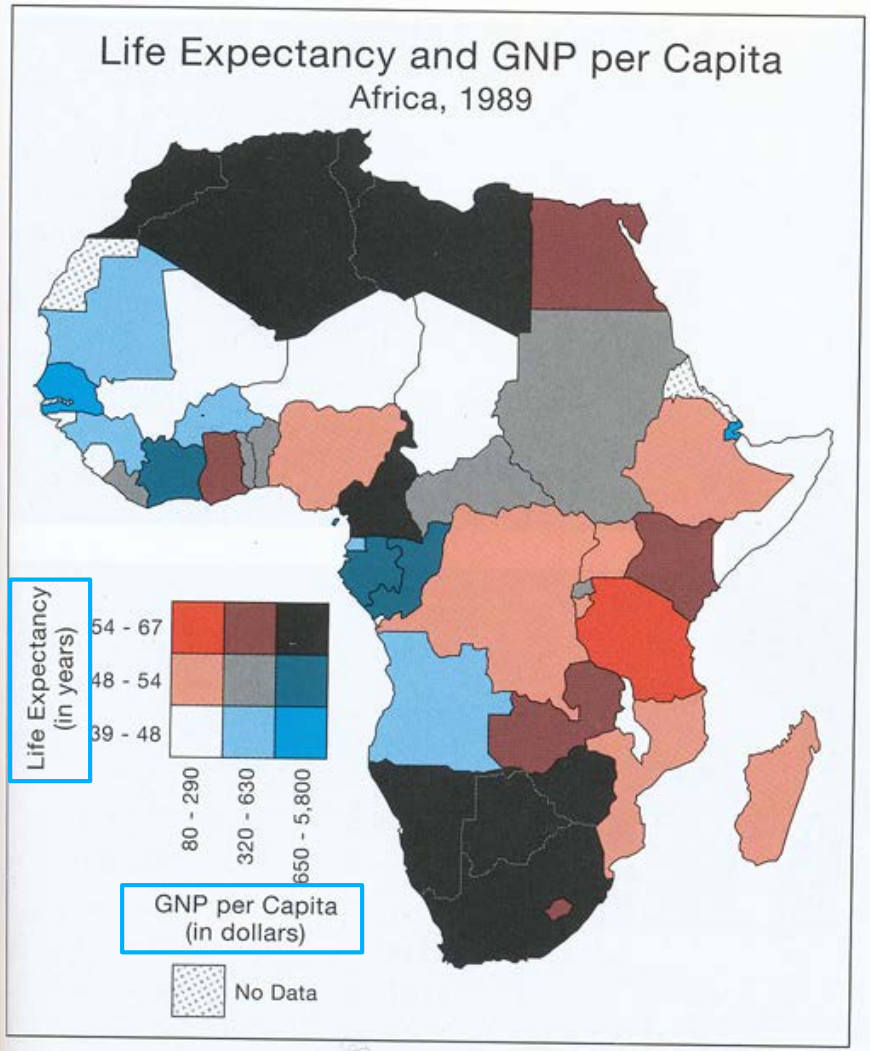
(DiBiase 1990)

Bivariate and multivariate mapping

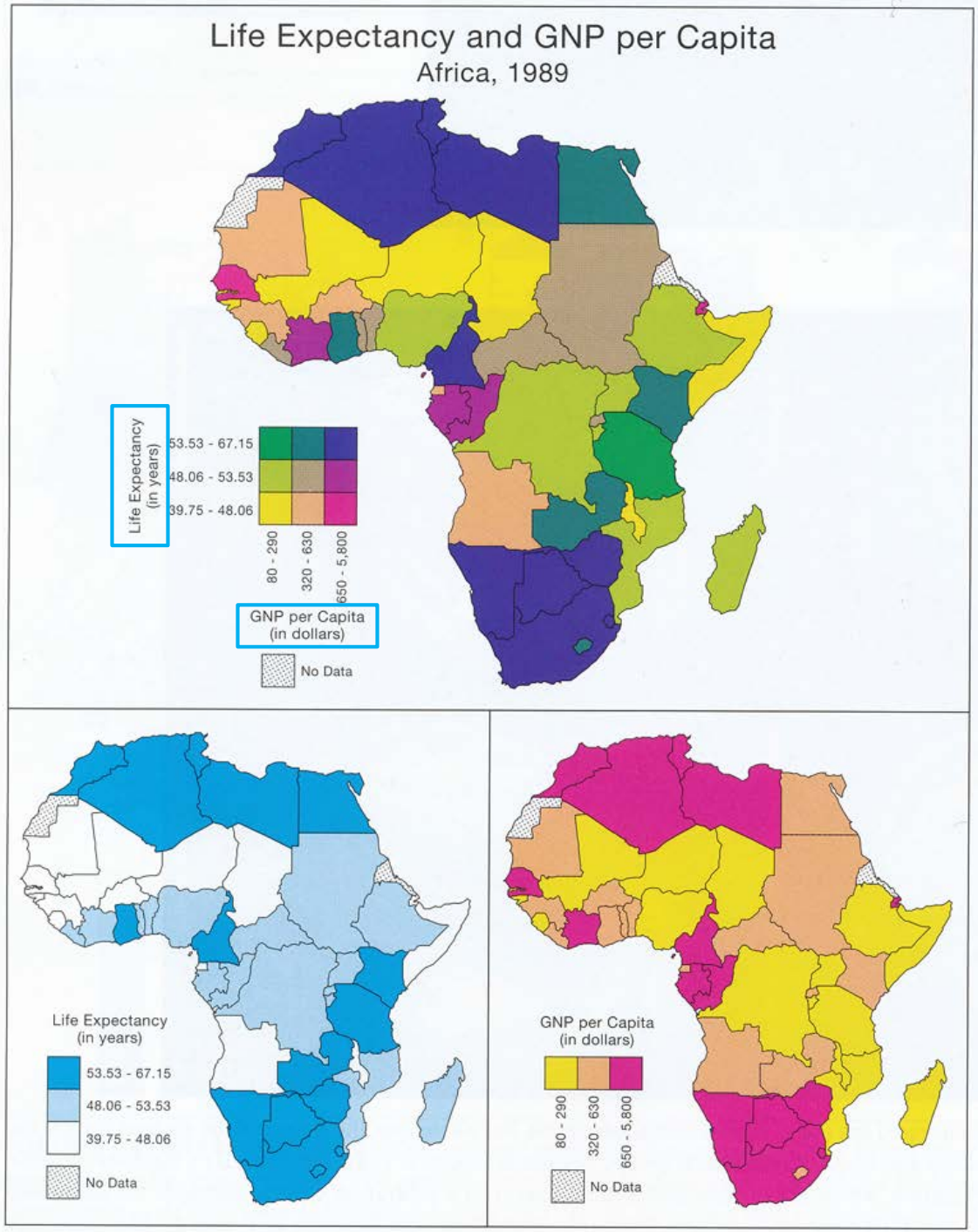
- Bivariate mapping
  - Combining two attributes on the same map using two complementary colors on the color wheel
    - Examples (next slides)
      - Color plates 18.1, 18.2, 18.3 (Plates 16, 17)
      - Figure 18.4 (p.334)



Source: elizabeth-ashley-photography.blogspot.com

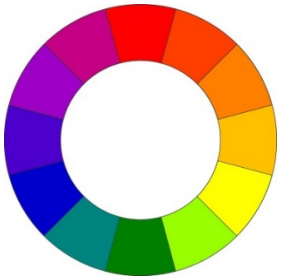


COLOR PLATE 18.2 A bivariate choropleth map based on the complementary colors red and cyan. (After Eyton 1984a.)



COLOR PLATE 18.1 A bivariate choropleth map and its component univariate maps. The color scheme was taken from Olson (1981, p. 269) and is similar to those popular on U.S. Bureau of the Census maps in the 1970s. A quantiles classification was used for each map because the GNP data were positively skewed. (Data Source: ArcView 3.)

complementary colors?



Source: elizabeth-ashley-photography.blogspot.com

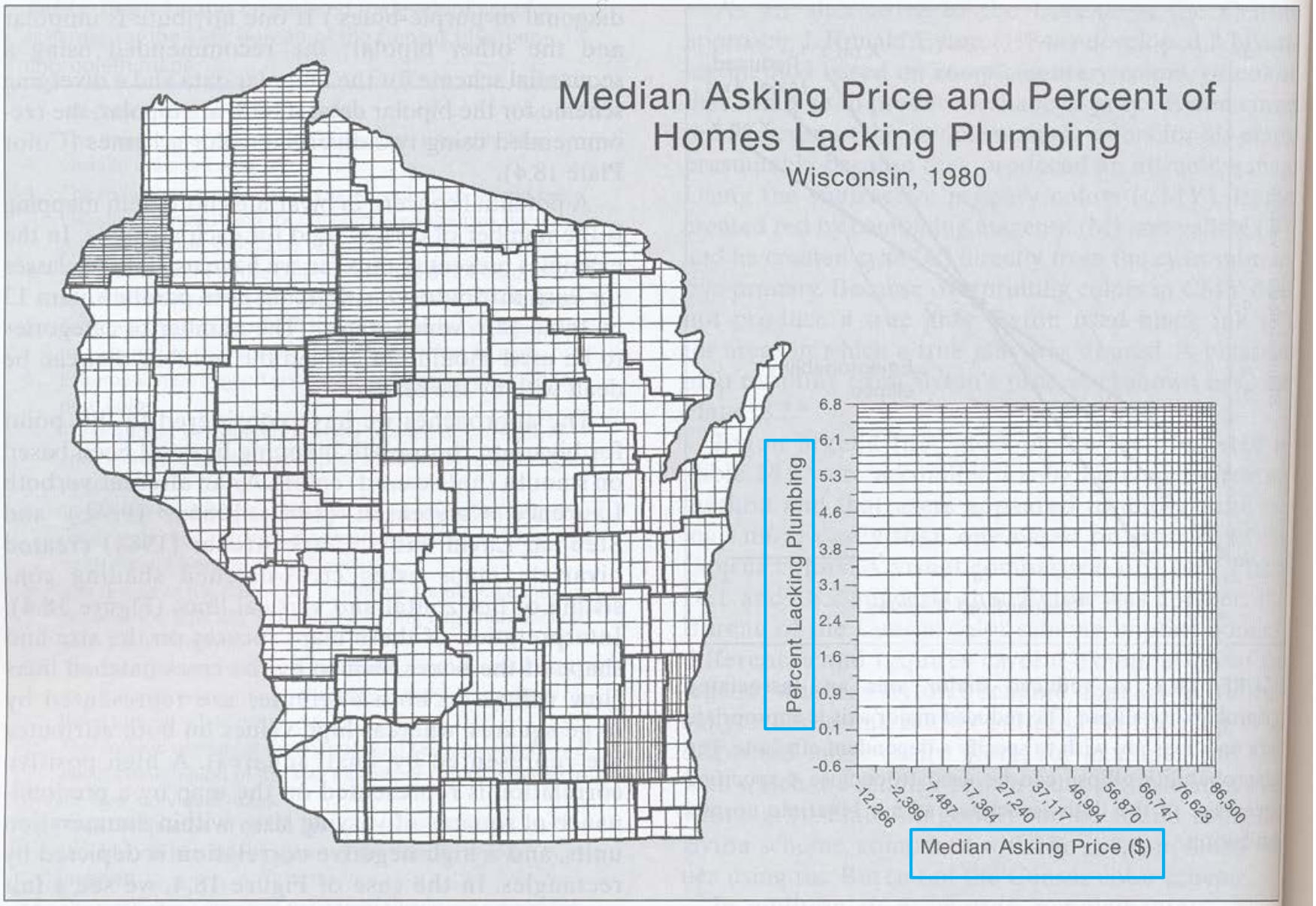


FIGURE 18.4 A bivariate choropleth map based on cross-hatching (the attributes are represented by horizontal and vertical lines of varying spacing). Note that each attribute is unclassed; negative values in the legend are a function of the major axis scaling used to fit the bivariate data. (From Carstensen 1986a, p. 36; courtesy of Laurence W. Carstensen.)

Bivariate mapping

- Bivariate point symbol

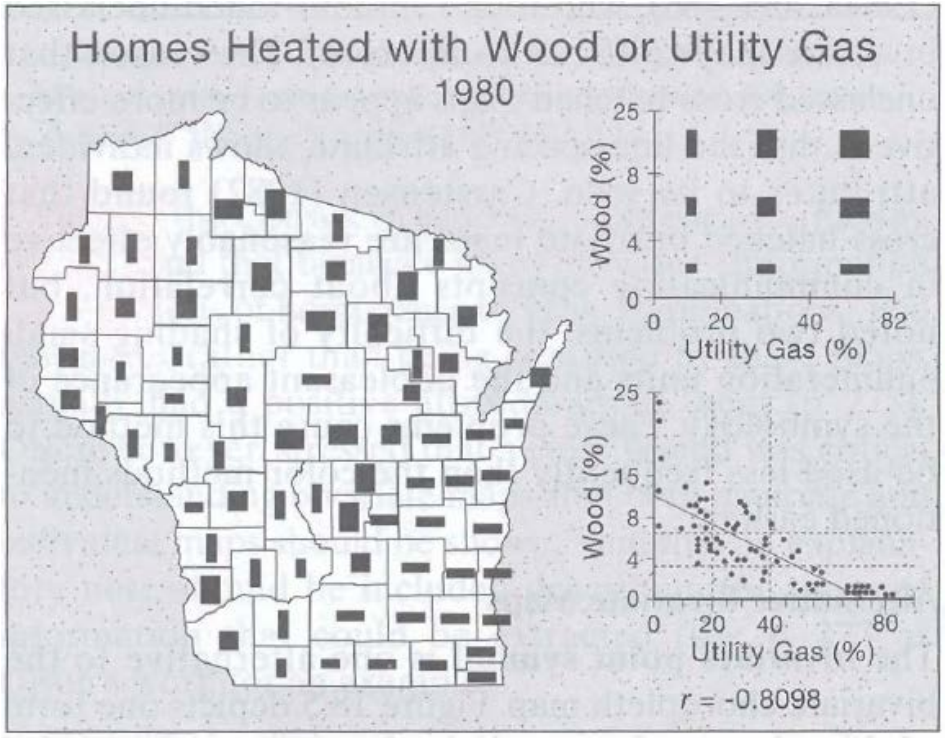


FIGURE 18.5 A bivariate map in which attributes are represented by the width and height of a rectangular point symbol. (Courtesy of Sean Hartnett.)

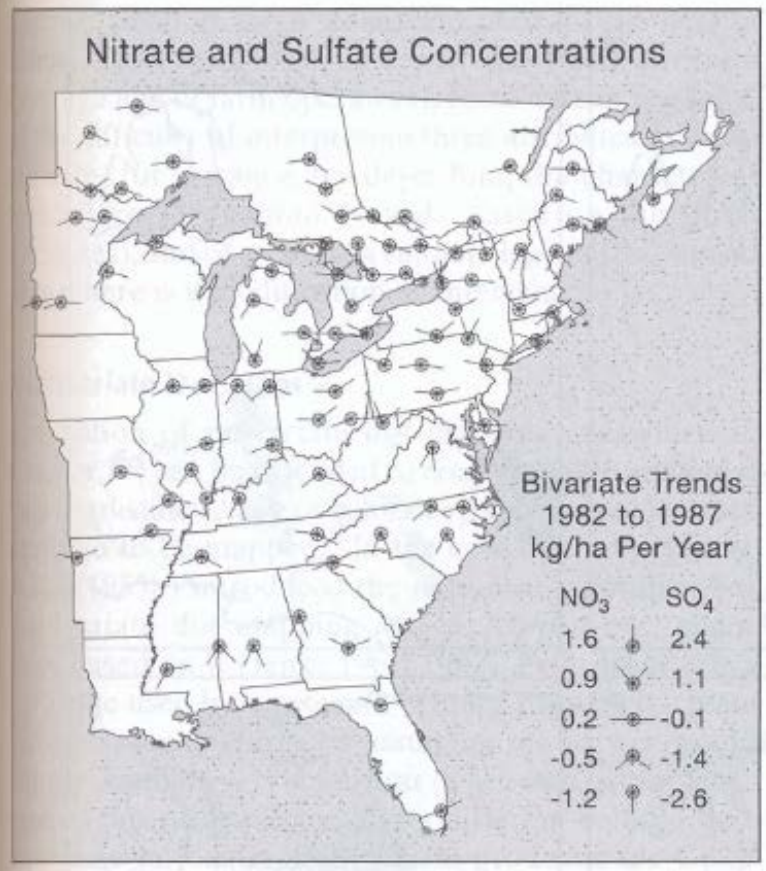


FIGURE 18.6 A bivariate map based on a ray-glyph symbol. Rays (straight-line segments) pointing to the right and left represent sulfate and nitrate concentrations, respectively. (After Carr et al. 1992. First published in *Cartography and Geographic Information Systems* 19(4), p. 234. Reprinted with permission from the American Congress on Surveying and Mapping.)

Bivariate mapping

- Some factors that can be considered in developing color schemes for bivariate maps
  - Table 18.2 (p. 332)

TABLE 18.2 Factors considered in developing color schemes for the U.S. Bureau of the Census bivariate choropleth maps

1. All colors must be distinguishable.
2. The transition of colors should progress smoothly in a visually coherent way.
3. The individual categories of each distribution should be visually distinguishable or coherent, and the two distributions as a whole should be separable from one another.
4. The arrangement of the colors presented in the legend should correspond to the arrangement of a scatter diagram.
5. Tones should progress from lighter to darker corresponding to a change in the numerical values from low to high.
6. Extreme values (legend corners) should be represented by pure colors.
7. There should be coherence in the triangle of cells above and below the main diagonals to show positive and negative residuals.
8. To convey relationships, positive diagonals (lower left to upper right) and negative diagonals (upper left to lower right) should have visual coherence.
9. The design of the color-coding scheme should take into account the difficulty in mentally sorting large numbers of colors in the legend.
10. The color scheme should relate to the data in such a way that the map relationship reflects as closely as possible the statistical relationship.
11. The crossed version of the map should be constructed as a direct combination of the specific sets of colors assigned to the two individual maps.
12. The combination of colors on the two individual maps should look like combinations of the specific colors involved.
13. The number of categories to be used should not exceed the number that can be dealt with by the reader. A 3 × 3 legend is both mechanically and visually simpler than a 4 × 4 arrangement and might actually convey more to the reader.
14. Alternatives to a rectangular arrangement to the legend should be considered. The rectangular form creates map interpretation problems and affects the message of the statistical relationship.

After Olson 1975b, as specified by Eyton, J. R. (1984a) "Complementary-color two-variable maps." *Annals, Association of American Geographers,* 74, no. 3, p. 480. Courtesy of Blackwell Publishing.

Questions…?

- Until next time…
  - Reading
    - Slocum et al. (2009), Ch. 3 & Ch. 18

- Worksheet (WS) 1 due 9/11

- Sign up for your map presentation, if you have not done so yet
  - Discussion menu on the BeachBoard
  - Preferred date & the link of the map

Specific evaluation criteria and points of the course

- 1. Total points of the course: 100% = 1000 points
- 2. In-class work & Homework (26% of total points of the course: 260 points)
  - Attendance (40 points)
  - Map presentation (20 points)
  - Worksheets1, 2, 3 (30, 20, 30 points)
  - Labs 1, 2, 3 (40, 40, 40 points)
- 3. Term project and related work (34% of total points of the course: 340 points)
  - PM1 (20 points)
  - PM2 (100 points)
  - PM3 (70 points)
  - Final presentation (150 points)
- 4. Quiz and Test (20% of total points of the course: 200 points)
  - Test1 (100)
  - Test2 (100)
- 5. Final exam (20% of total points of the course: 200 points)