Dot Density Maps I

GEOG380 FA 2018
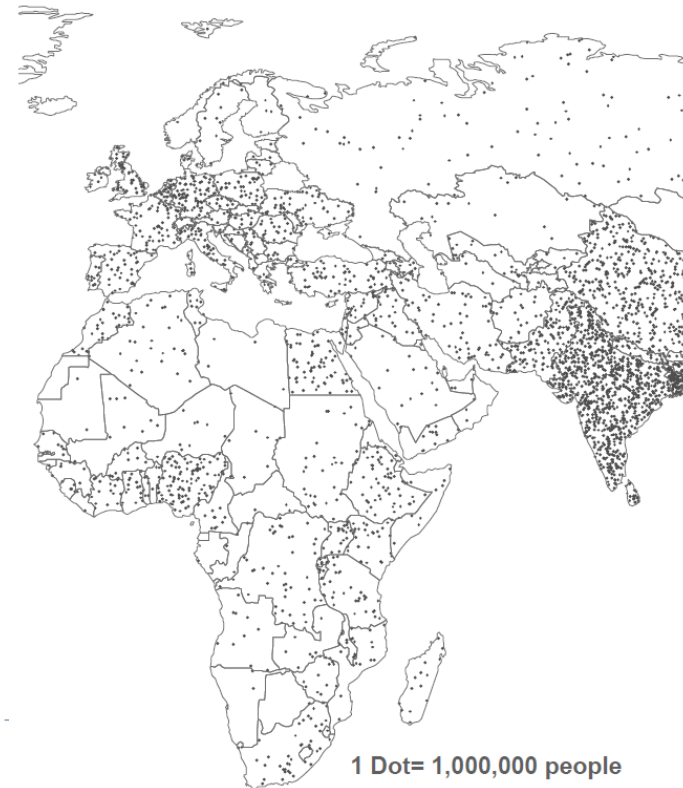
Outline

- Dot density maps I
  - Qualitative dot mapping
  - Proportional Point Symbolization

- Dot density maps II

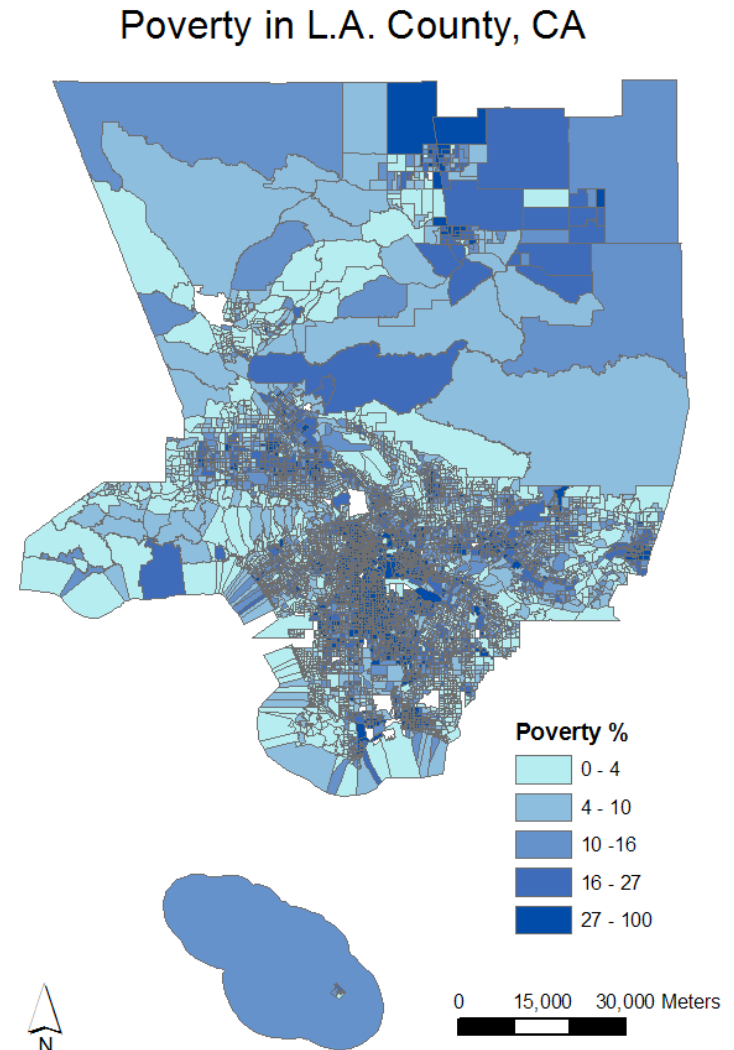# Dot density maps

▸ Recall some dot maps shown in the previous lectures…

▸ Questions to ponder

  ▸ What are dot maps?

  ▸ What can you do with the dot maps?

 ▸ What are their advantages and disadvantages over other mapping techniques?

1 Dot= 1,000,000 people

Dot mapping compared to choropleth mapping

▸ **Recall from earlier lectures: choropleth maps are for "areas" mapping**

  ▸ e.g. A map of Los Angeles County: census block-groups showing the proportion of the population below the federal poverty level

  ▸ The map shows proportion but does not reflect the total population because it was standardized

    ▸ *How to calculate the proportion?*

Poverty in L.A. County, CA

Poverty %
- 0 - 4
- 4 - 10
- 10 - 16
- 16 - 27
- 27 - 100

0   15,000   30,000 Meters

N

The common dot map

- A direct symbolization of object density
  - Discrete objects
  - Absolute counts
    - Ex. total population, number of 49ERS fans, in L.A. County, etc
  - The map shows the number of people in poverty as dots
    - Each dot represents certain number of people indicated
  - Locations of the dots do NOT represent true locations but only serves as an indication (arbitrary locations)

Poverty in L.A. County, CA

1 Dot = 200 persons

0   15,000   30,000 Meters

N
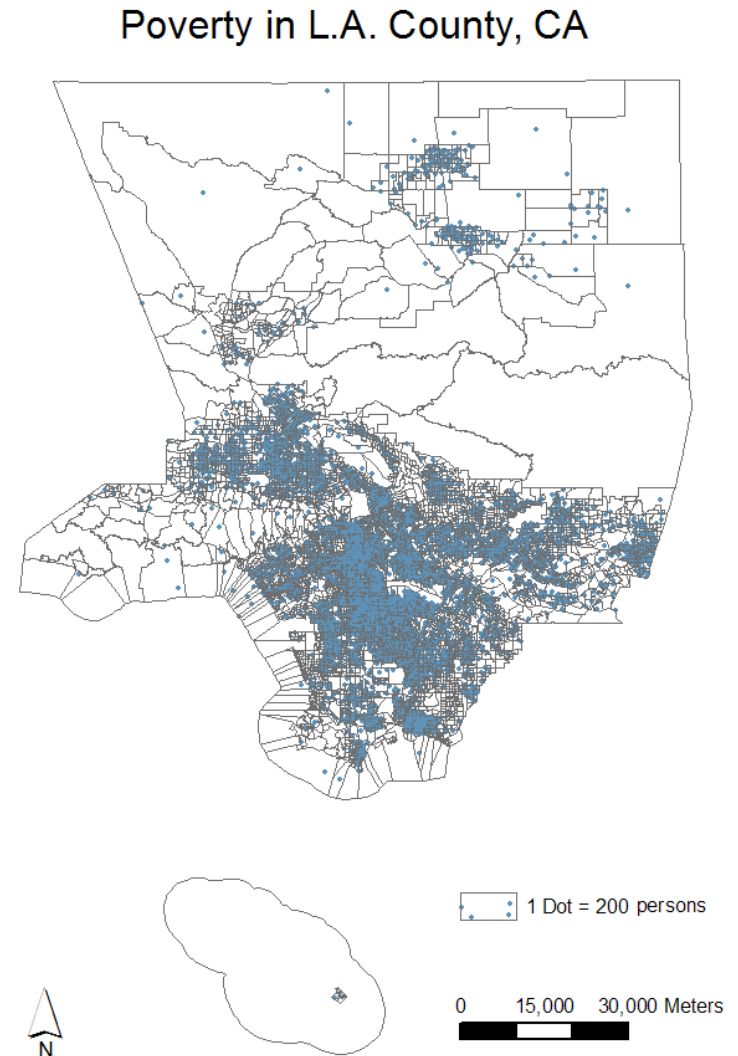
Two types of dot maps

- *A dot equals an observation*
  - *One-to-one relationship* between the symbol and the object, process, or phenomenon
- *A dot equals more than one observations*
  - *One-to-many relationship* between the symbol and the objects, processes, or phenomena
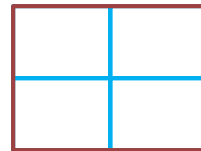 - Concept of a spatial proxy

1 Dot= 1,000,000 people

Size and value guidelines

- General rule for enumeration units in mapping
  - The smaller the statistical unit in relation to the overall size of the map, the greater the accuracy of dot distribution in the map
 - Recall MAUP!
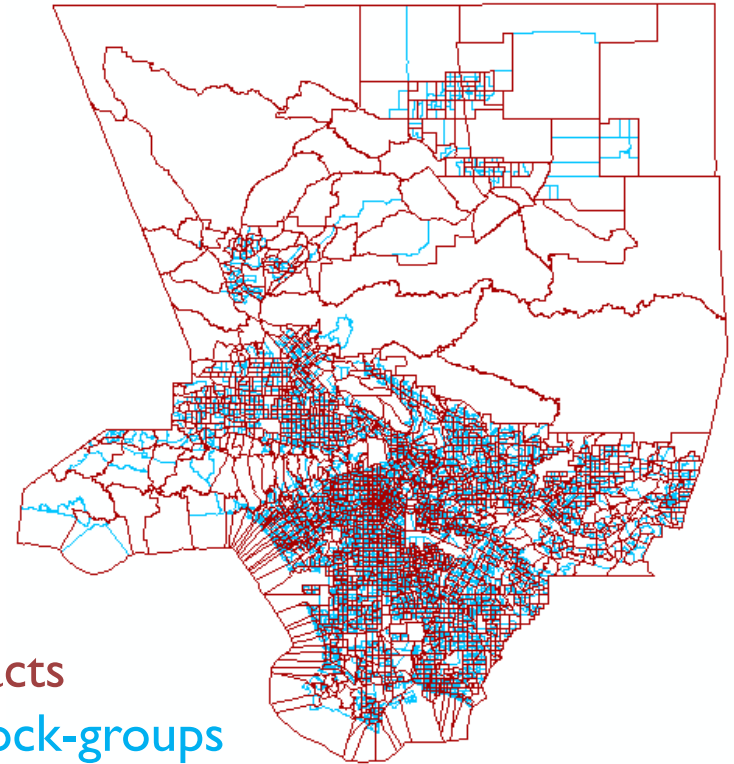
Census Tracts
Census Block-groups

Size and value guidelines (cont.)

‣ What are dot size and dot value?

‣ Balance between dot size and dot value

  ‣ Strive for 2-3 dots in area with lowest value (the smallest number of dots within an areal unit)

Not like this   Like this

‣ Dots begin to clutter (coalesce) in areas with highest values

‣ Use intuitive dot values—e.g. 5, 50, 100—rather than 6, 46, and 87.3

‣ Again, look for balance in the map

  ‣ Neither too accurate nor too general…how the heck do you do that?

    ➜ Experiments with different sizes and values!

‣
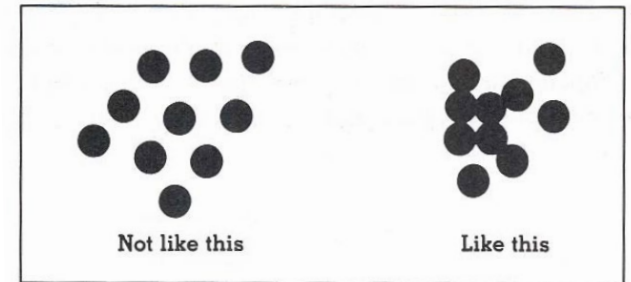
The subjectivity of dot size and dot value

▸ Can you see the subtle differences in these maps?
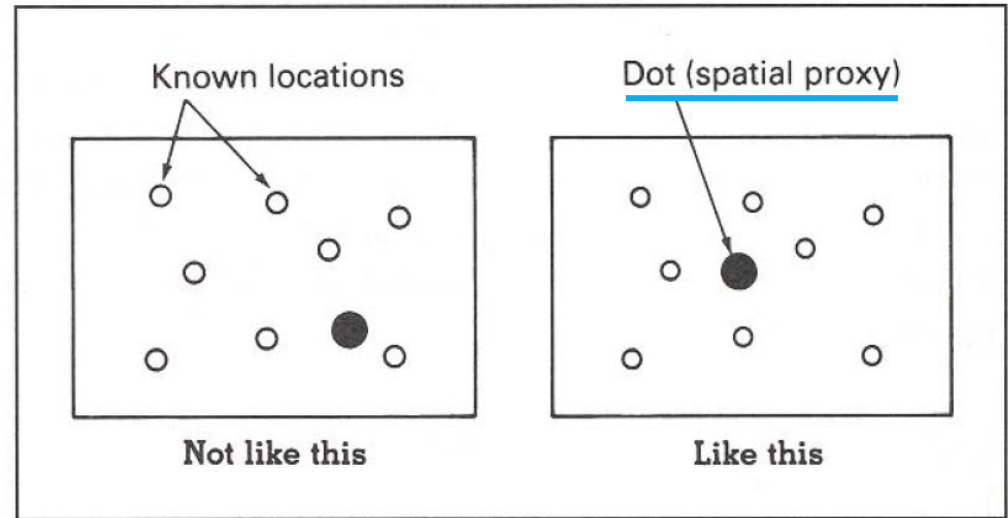
▸ Which is the best? Why do you think so?
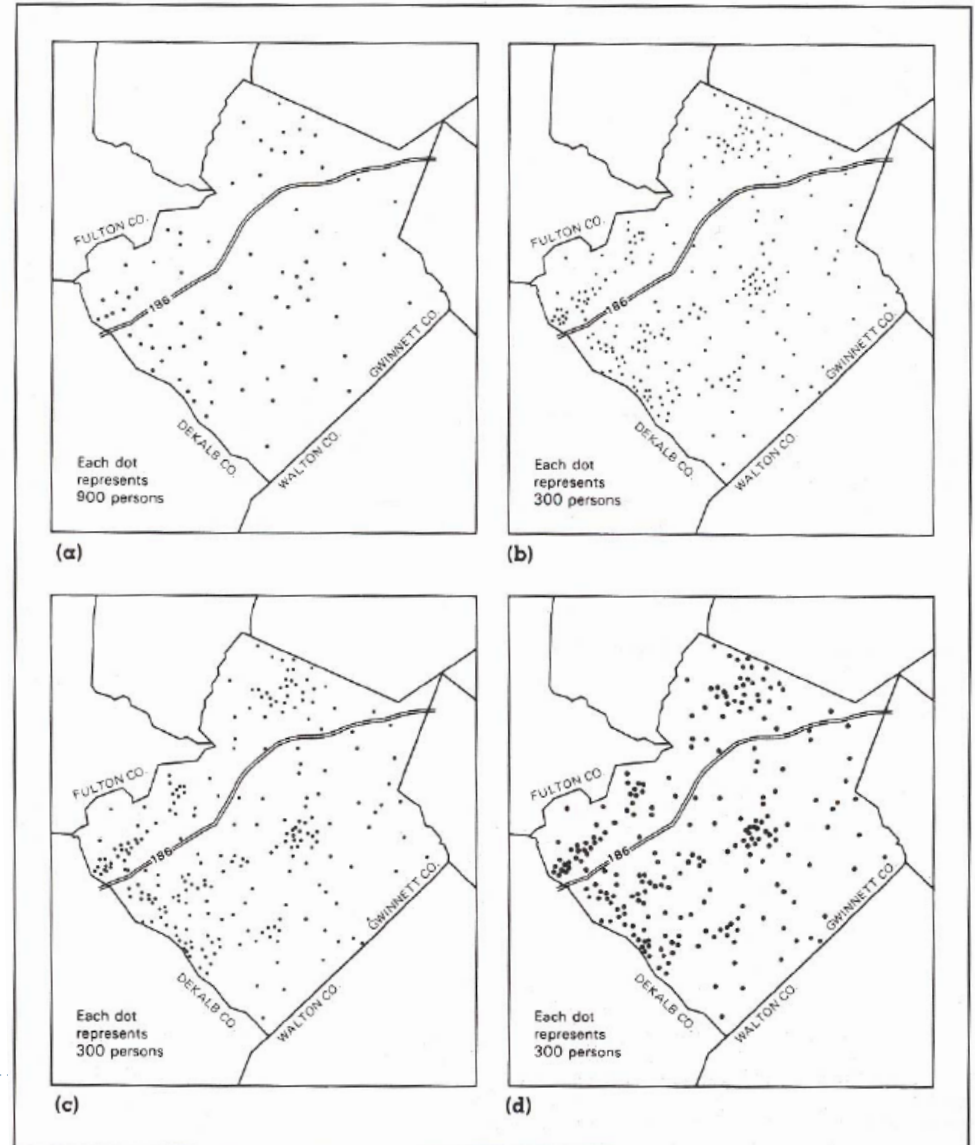
(Source: Dent 1999)

Dot placement

- The Center of gravity principle
  - Locate dots as close as possible to their real distributions to better represent spatial density of the data
  - Ex. Spatial mean

(Source: Dent 1999)

Placing dots

▸ Point location

  ▸ Uniform (random)

    ▸ Not optimal because in reality patterns are not uniform

  ▸ Geographically weighted (principle of spatial autocorrelation)

    ▸ Higher values tend to be located near other high values based on the uniform pattern

  ▸ Geographically based

    ▸ Use above principles, but also use ancillary information of areas where the observations might locate in reality to place the dots
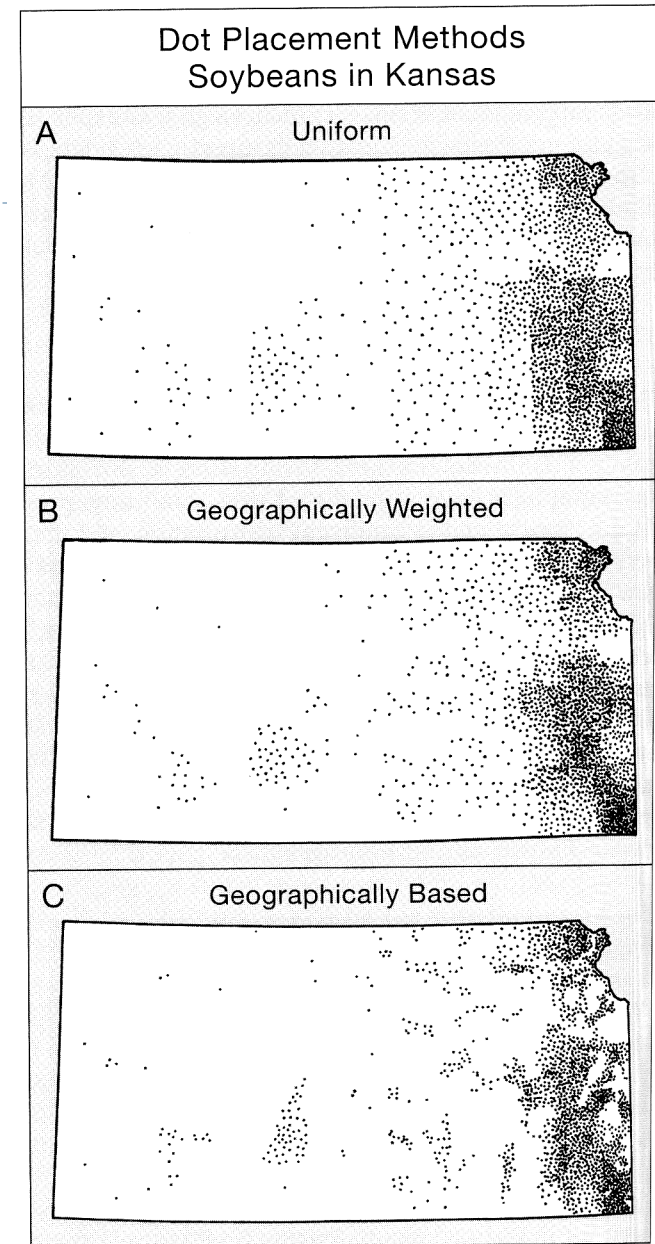
Source: Slocum et al. (2009)

Dot Placement Methods
Soybeans in Kansas

A   Uniform

B   Geographically Weighted

C   Geographically Based

FIGURE 17.20   Approaches used by cartographers to place dots on a dot map: (A) uniform, (B) geographically weighted, and (C) geographically based.

Exercise

‣ Make a group of 3~4 people around you

‣ Let's find some dot-maps that show appropriate phenomenon, process, or feature using appropriate cartography

  ‣ See what type of data do the maps use

  ‣ See what statistical unit do the maps use

  ‣ Think about why the dot mapping was used in the map

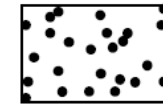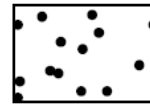 ‣ Share your group's findings with others

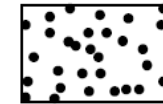# Dot legend design

▸ Dot-density perception

  ▸ Not linear

  ▸ Apparent density ≠ geometric density

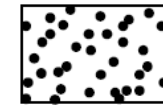   ▸ Number of dots typically underestimate

    ▸ Densities also underestimated

Which is twice the amount ?

Dot map legends

▸ All legends should include:

  ▸ A statement that tells the unit value of one dot

  ▸ A disclaimer for the reader

    ▸ i.e. , "One dot = 250 persons"

    ▸ i.e., "Each dot represents a particular value but does not always equal to it." (199 persons, 201 persons: how may dot(s) do we need?)

  ▸ At least include 3 squares that show different densities in the map

Fair legend:

Better legend:

• = 200 persons

= 1800 per/sq. mi.

= 1000 per/sq. mi.

= 200 per/sq. mi.
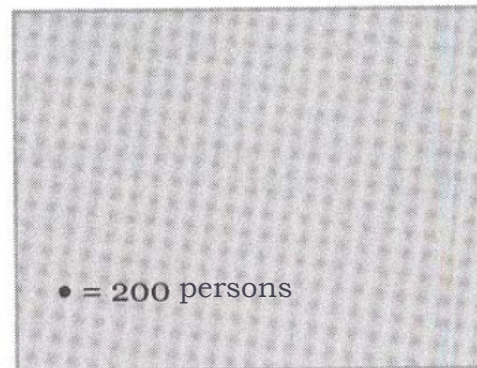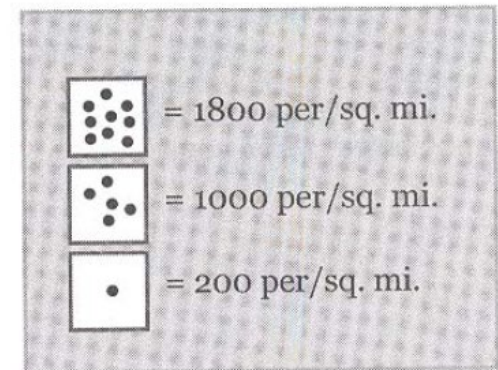
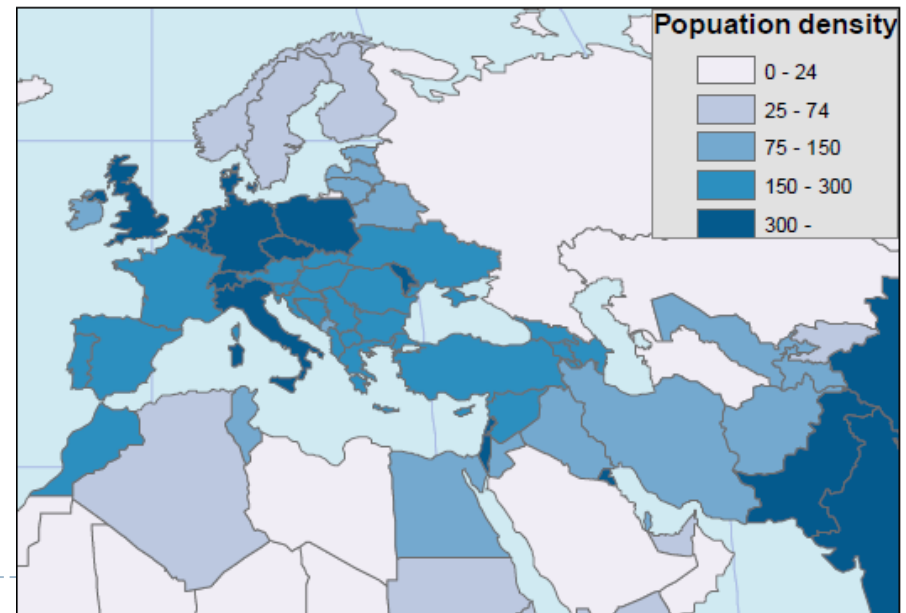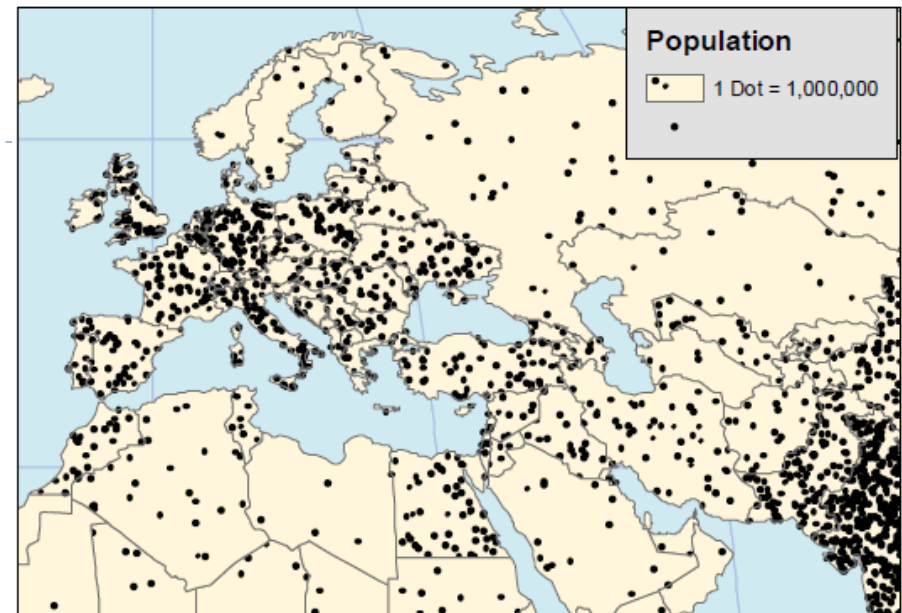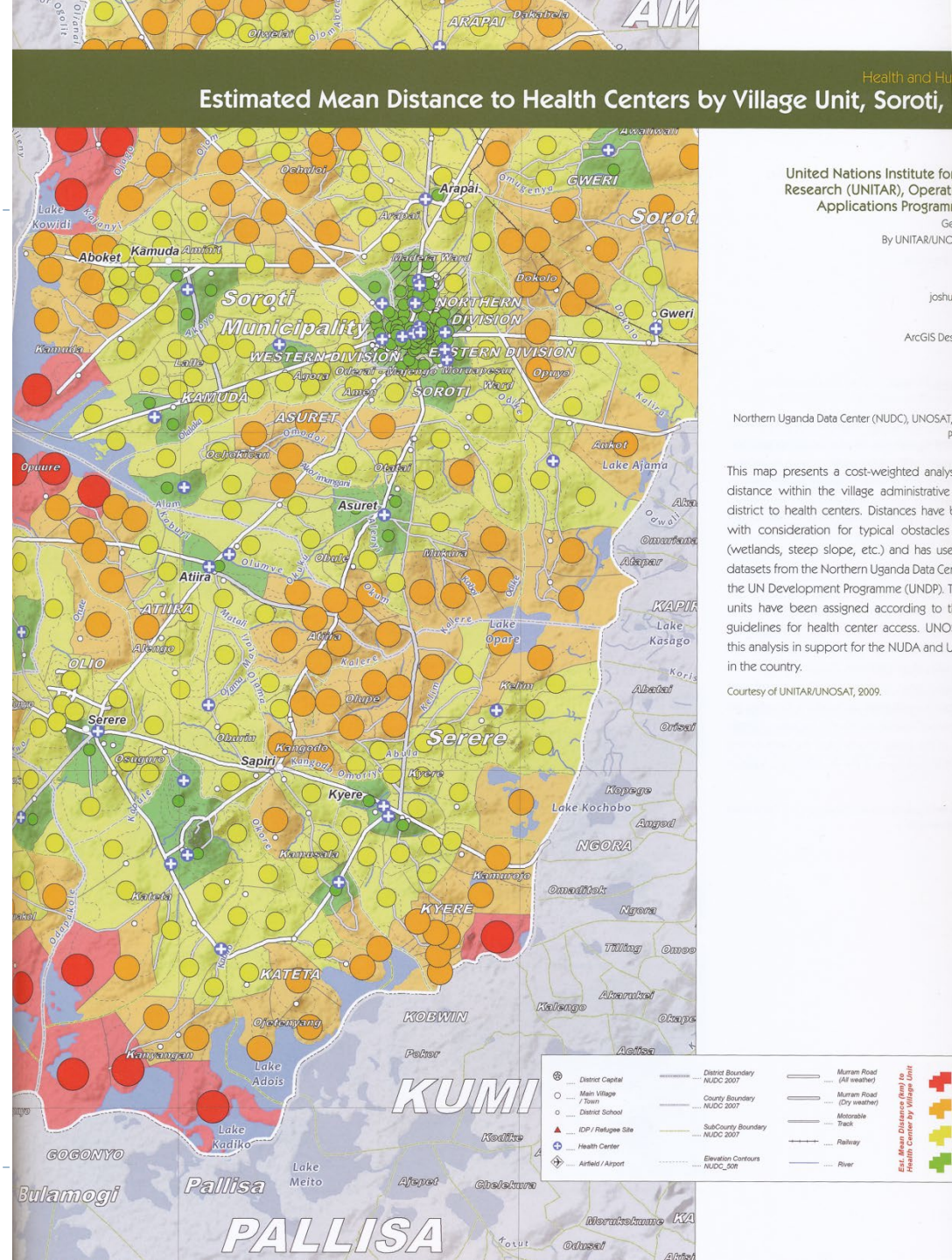# Pros. and cons.?

- Advantages
  - Intuitive, once understood
  - Can read original data from the map (unit in legend)
  - Great for mapping discrete elements: *why?*
  - Patterns are representative
- Disadvantages
  - Density estimation is tricky
  - *A dot can be misunderstood as one object*
  - Highly subjective to make
  - Data loss if too dense

Population
1 Dot = 1,000,000

Popuation density
0 - 24
25 - 74
75 - 150
150 - 300
300 -

Example

Estimated Mean Distance to Health Centers by Village Unit, Soroti,
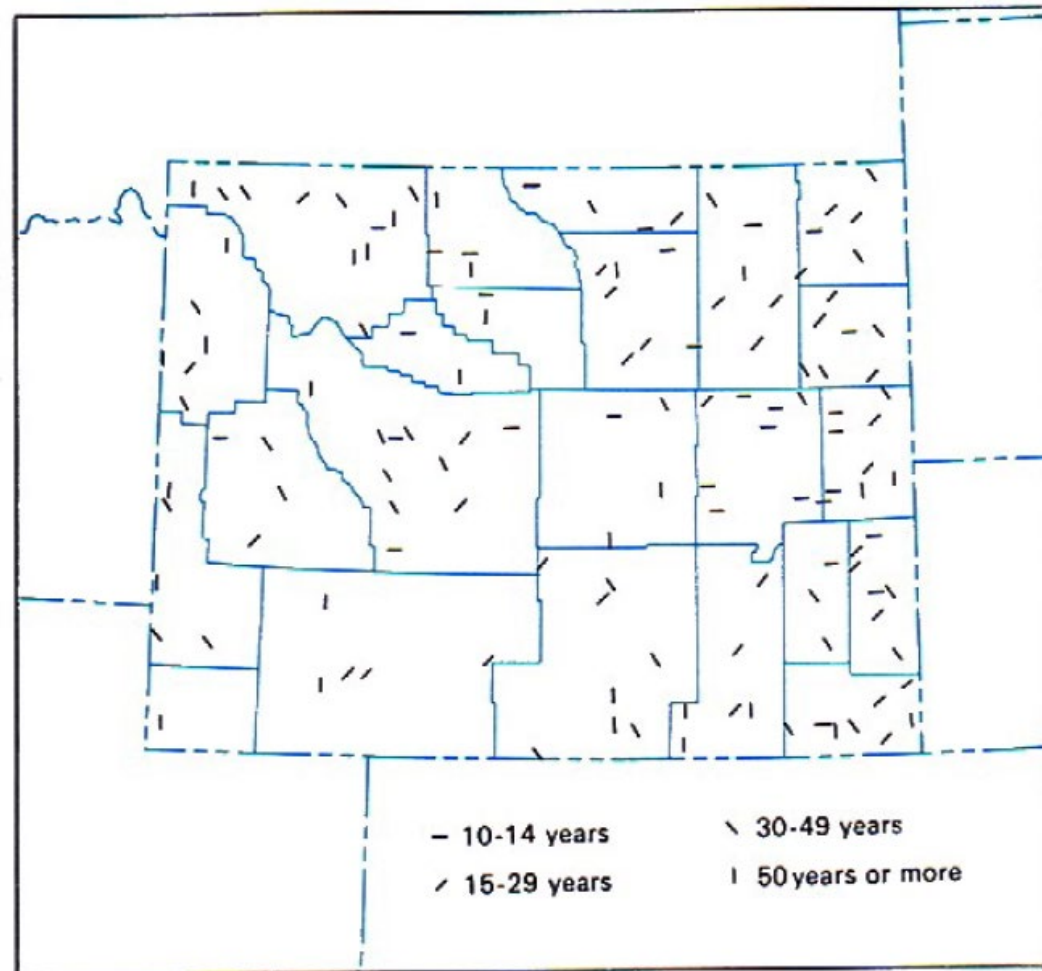
Qualitative Point Symbolization

▸ Useful dimensions (visual variables) of dot symbols

- ▸ Shape and texture
- ▸ Hue
- ▸ Orientation
  - ▸ Q. What do you think of the orientations of the symbology in the map? (*hint*: read the legend carefully)

- — 10-14 years
- ⁄ 15-29 years
- ＼ 30-49 years
- ∣ 50 years or more

What do you think of the symbology in the map?

Then… this?

OTL

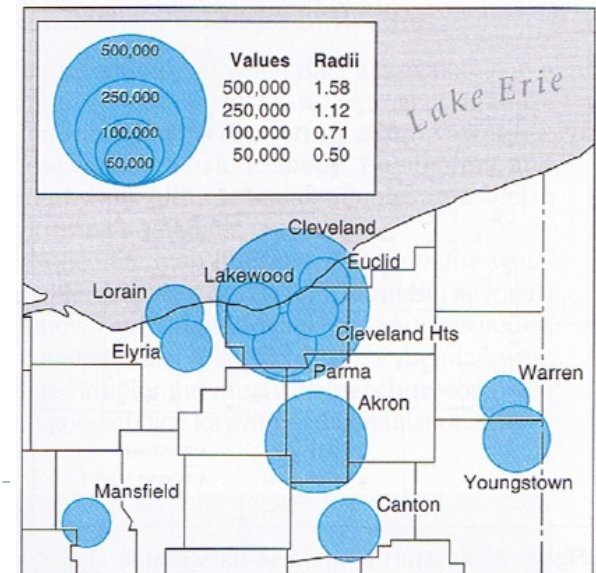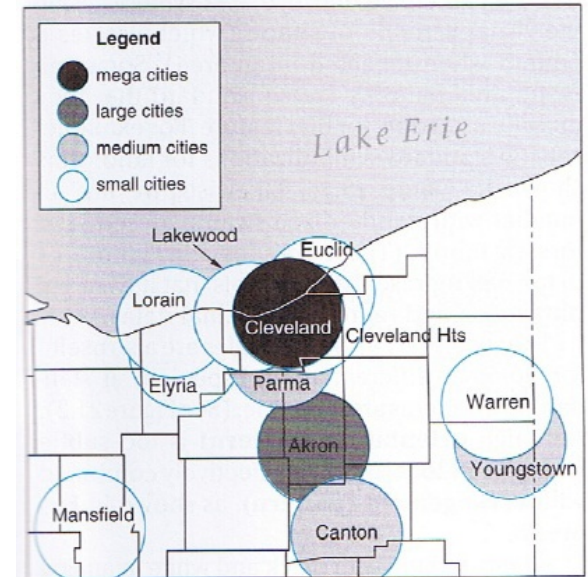# Proportional Point Symbolization

‣ Map symbol dimensions
   ‣ Size
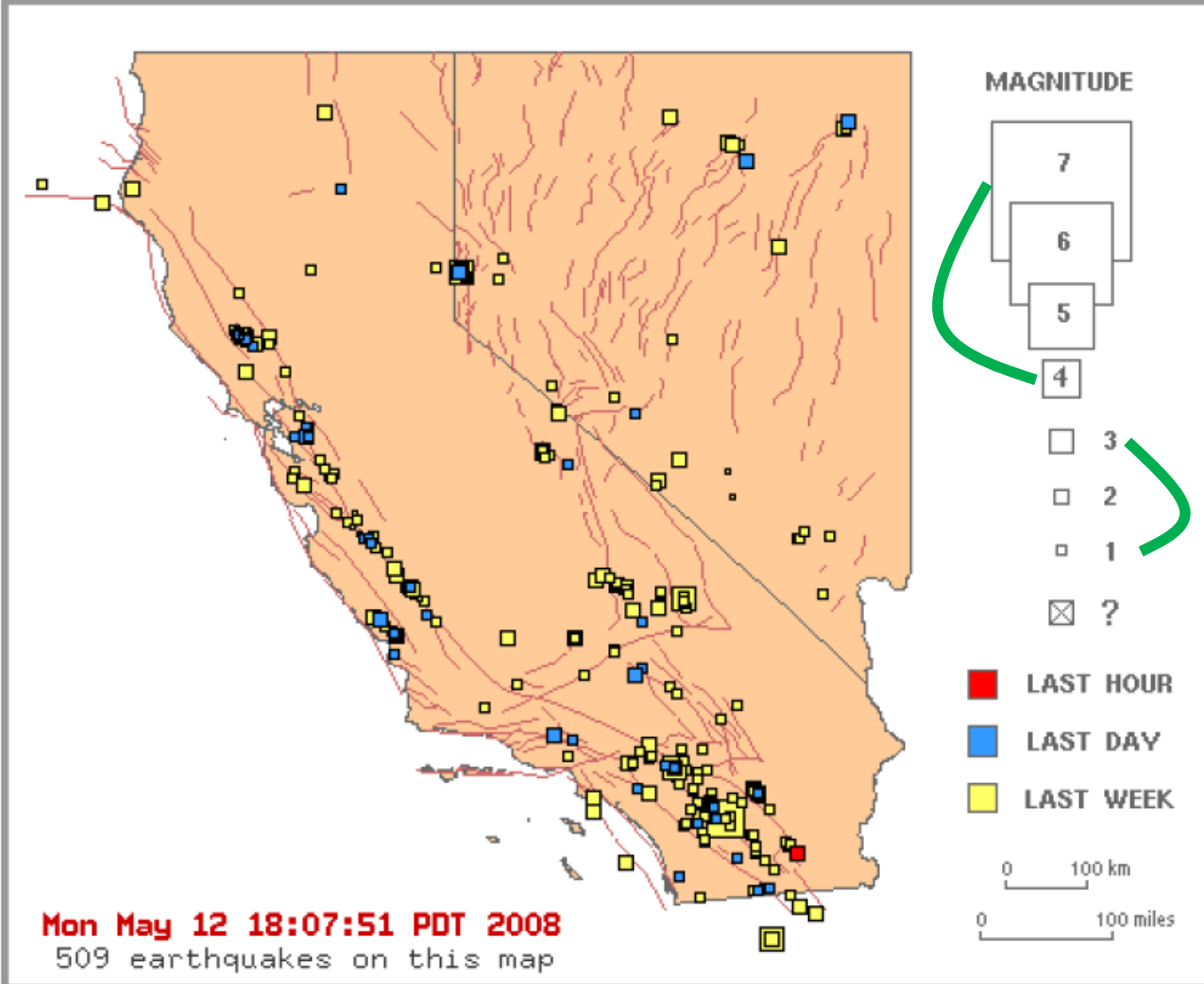   ‣ Value
   ‣ Chroma (color)
   ‣ Similar to the bubblegraph

‣ The use of colors should be limited

‣ Perceptual issue for "size"
   ‣ Not linear

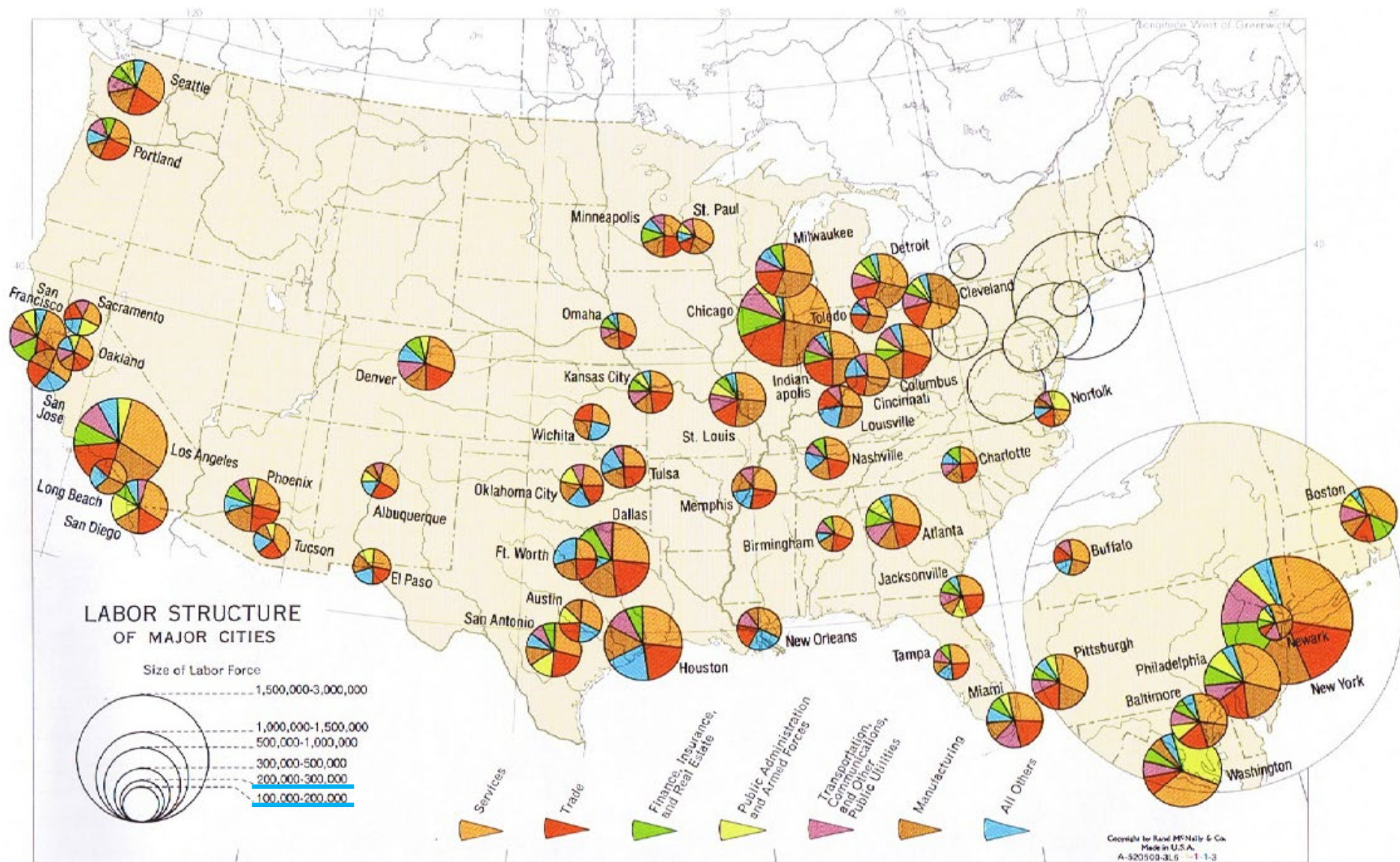(Source: http://quake.wr.usgs.gov/recenteqs/latest.htm)

(source: Goode's World Atlas)

Summary

- Dot density mapping
  - Size, value, and placement
  - Qualitative Point Symbolization
  - Proportional Point Symbolization

For next time…

- Reading
  - Ch. 17

- WS3 due 10/23

- Term Project introduction on 10/23