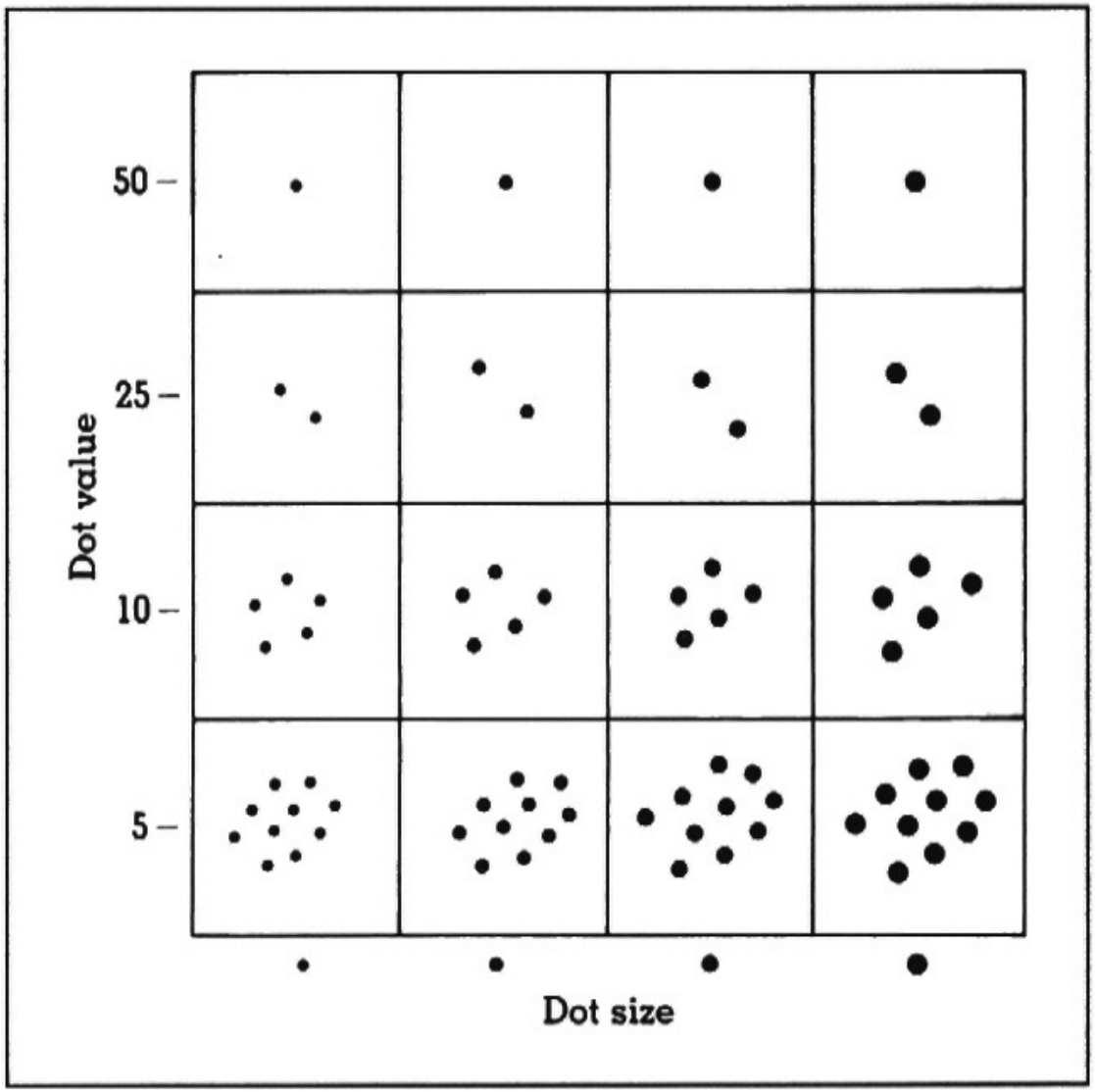
Dot Density Mapping II

GEOG380 FA 2018

Contents

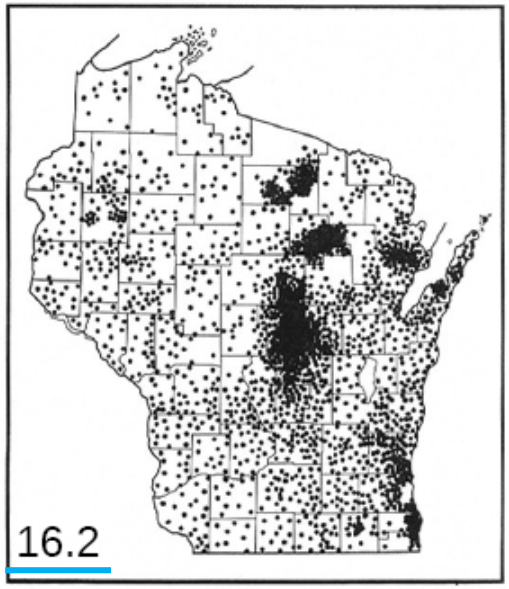
- Combining dot size and dot value
- Proportional symbol and dot mapping
- Perceptual issues

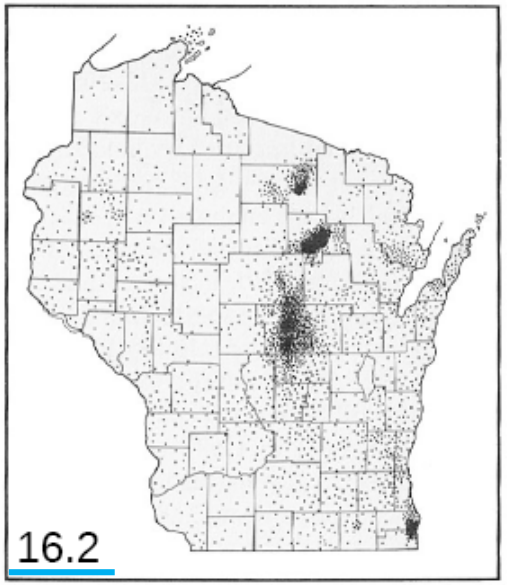
Effect of combining dot-value and dot-size (recall 'Dot Density Mapping 1' lecture note)

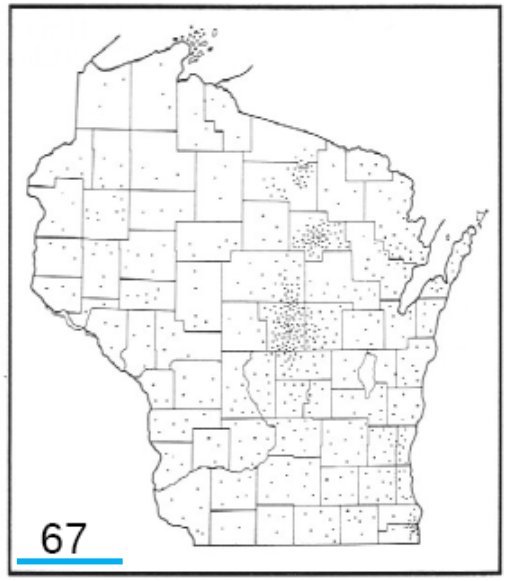


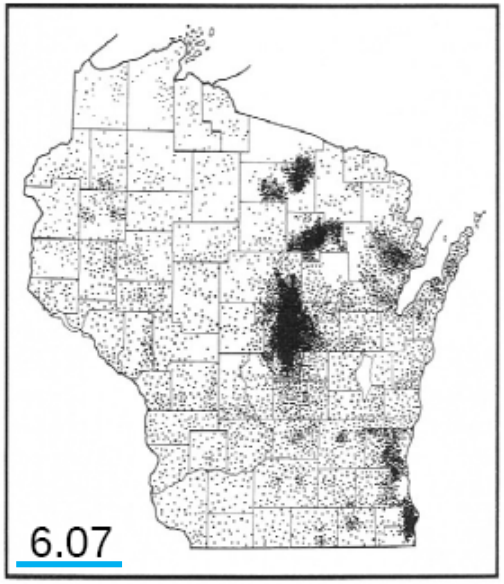
Land in Potato Production

Wisconsin, 1947









The number in each map represents the unit value (in hectares) of a dot.

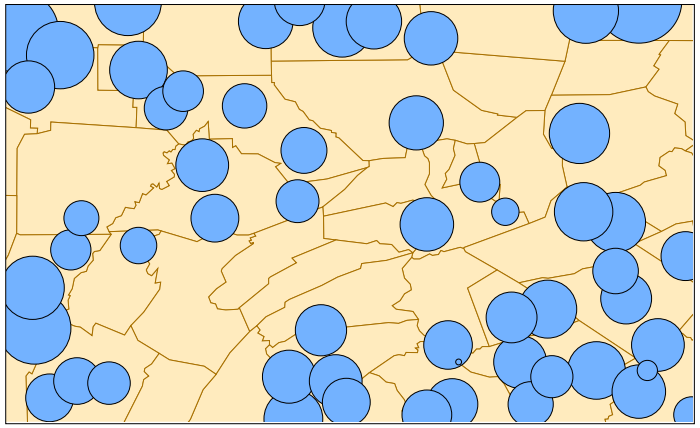
Q. The best one?

(source: Slocum et al.)

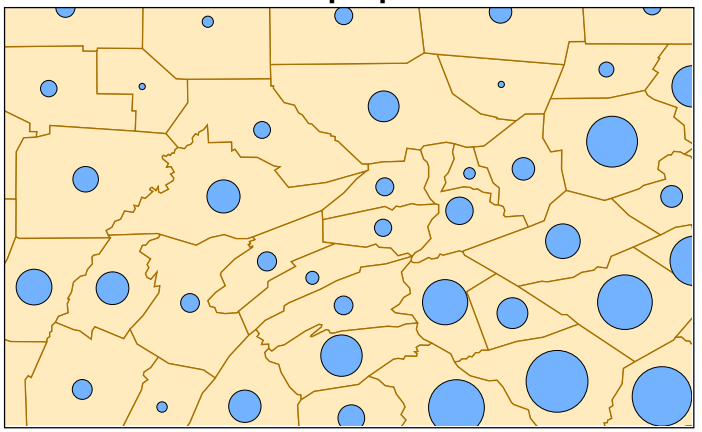
True and conceptual points

- Think about how the map scale matches spatial distribution of the phenomena
  - True points are always at correct (true) locations
  - Conceptual points can "move" around the map
    - Which points are true and which are conceptual below? How do you know?

Central PA annual snowfall



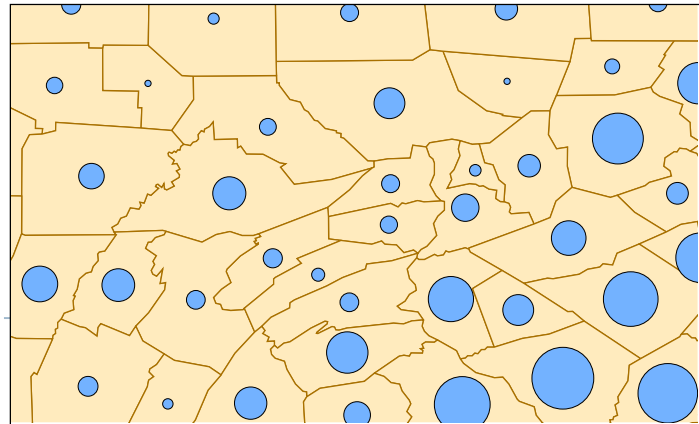
Central PA population



Proportional Symbol Mapping

- Uses a selected symbol varied by size throughout the map based on proportions of the quantities it represents
- Good for mapping…
  - total counts, OK with ratios
- Bad for mapping…
  - density or standardized information
    - ∵ Standardized values do not tell the original values
    - ex) choropleth mapping
  - A symbol varied by size *does not fill out* a unit area with the symbol
    → may lead misunderstanding

Central PA population



Handling overlap on proportional symbol maps

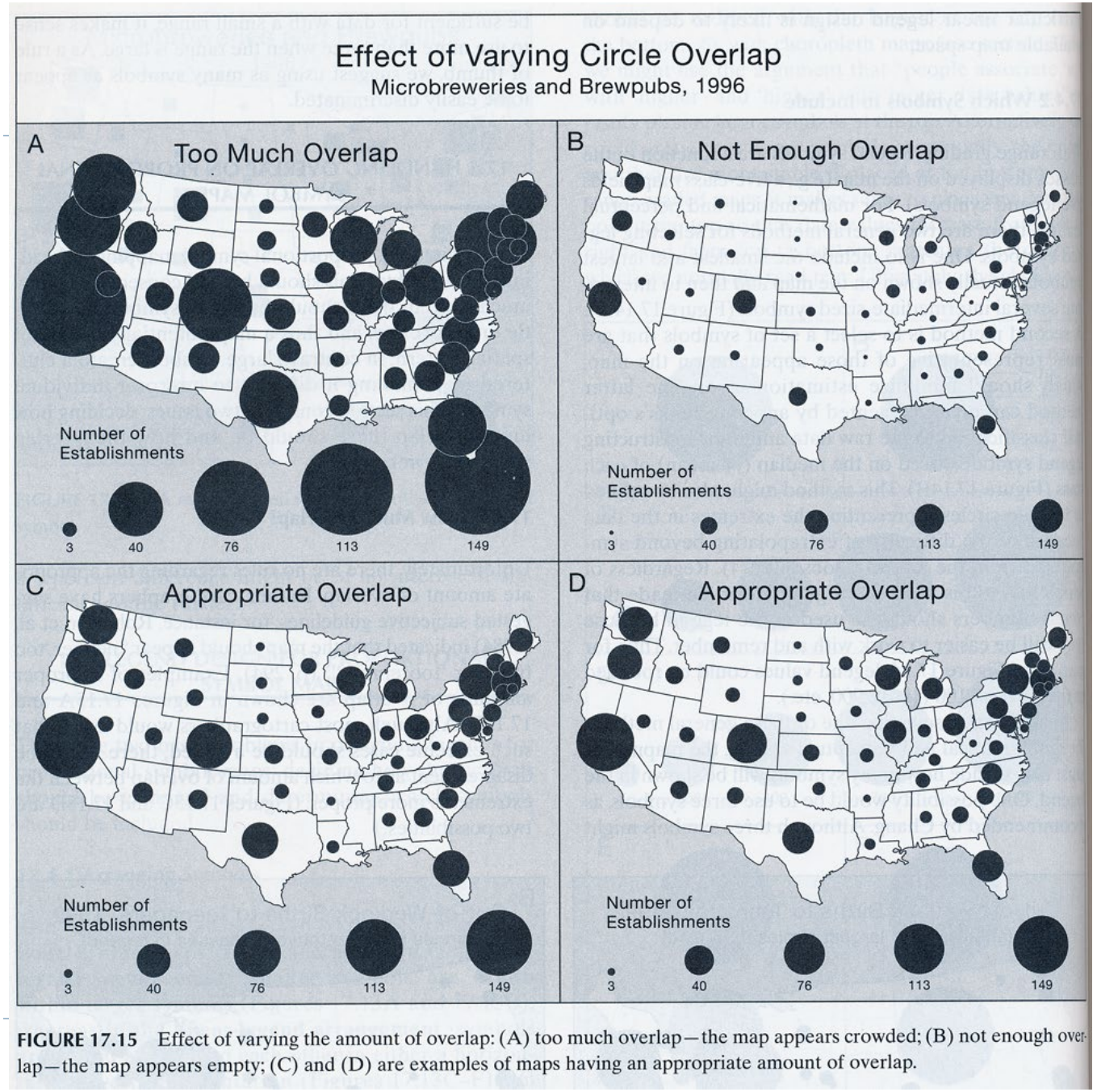
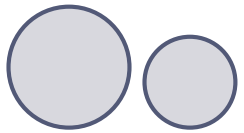


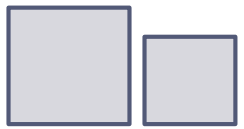
FIGURE 17.15 Effect of varying the amount of overlap: (A) too much overlap—the map appears crowded; (B) not enough overlap—the map appears empty; (C) and (D) are examples of maps having an appropriate amount of overlap.

Choice of the symbol in Proportional Symbol Maps

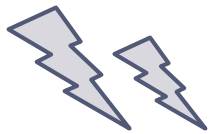
- Any symbol can be used, but circles and squares are preferred. Why?
  - Compact geometric form



  - More visually stable than other symbols
    - Less eye movement around the map

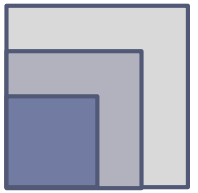


  - Scaling such symbols without computer is less difficult than other symbols



“Continuous” scaling of the symbols

- Mathematical scaling



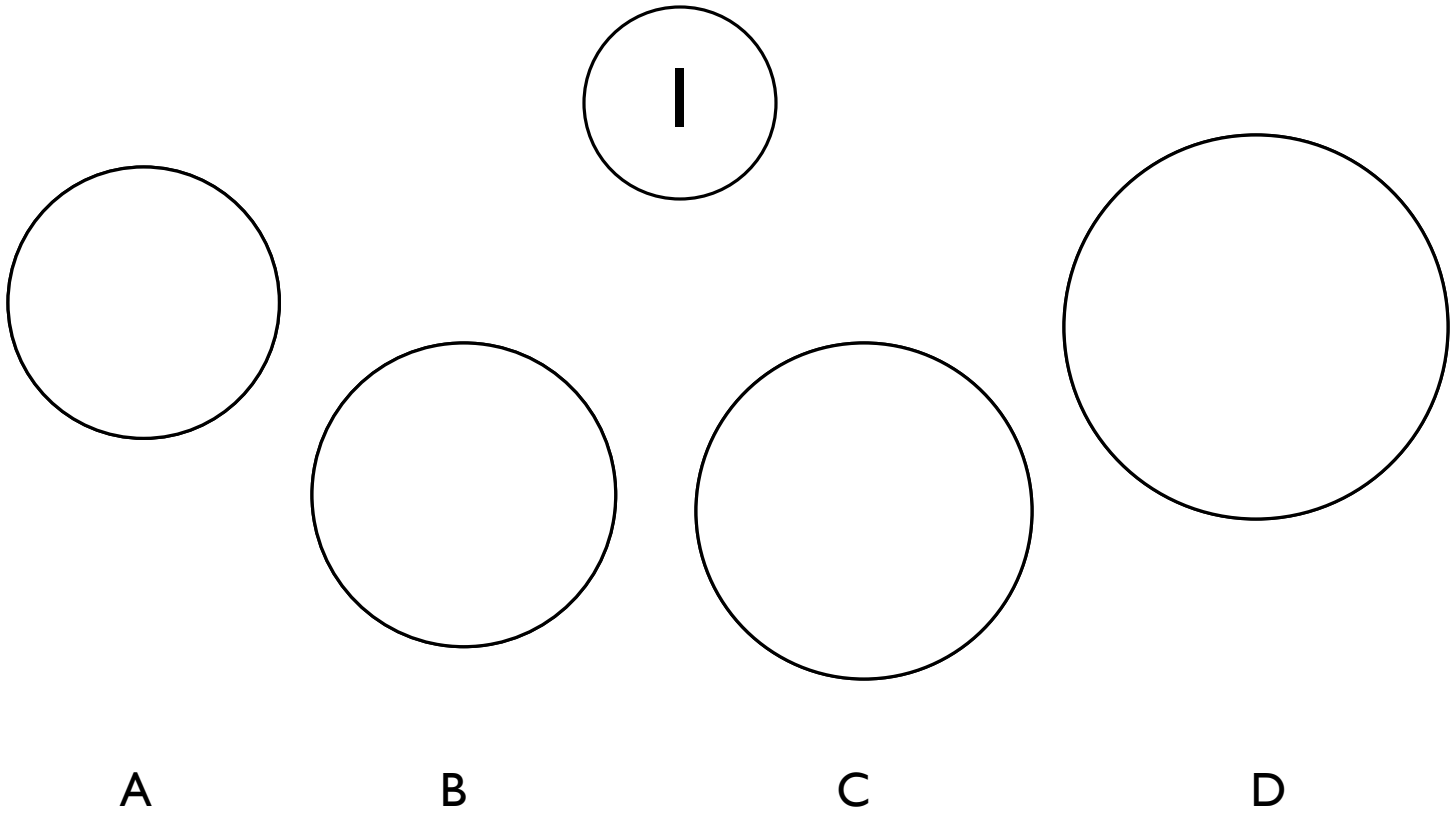
  - Follows a strict geometrical scaling to preserve area relationships proportional to attribute values
  - Simple linear formulas used for standard geometric symbols such as circles, squares, cubes, and spheres
    - E.g. if data values of a point object are 4 times larger than other data values, then the area of the point symbol is 4 times as large.

- Perceptual scaling
  - Follows a psychological scaling based on experiments so that a perceived size matches true values for human

?

Exercise: Scaling the symbols – perceptual issues

- Which of the circles is twice as big as the upper one?



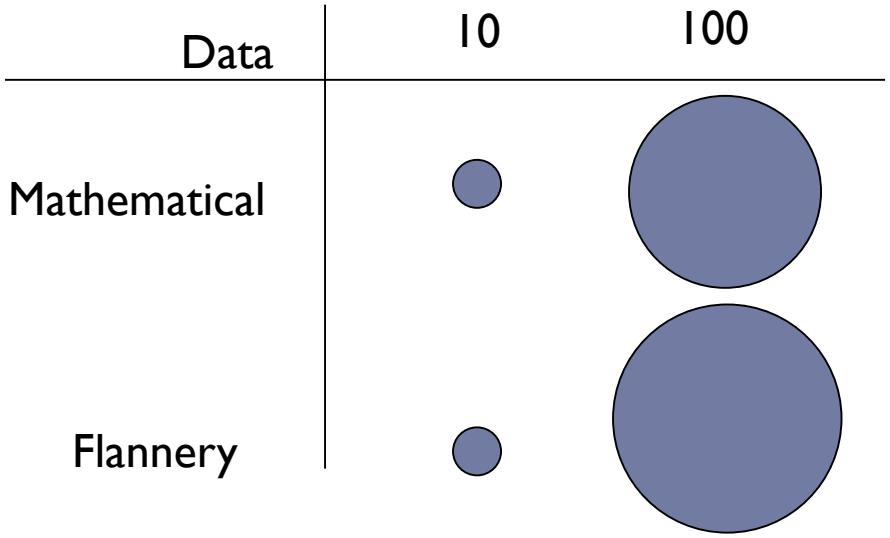
Scaling the symbols (cont.)

- Mathematical scaling
  - Area of points proportional to data
    - E.g. if data value is 10 times the other data value, then the area of the point symbol is 10 times as large.

- Map readers tend to underestimate the size of larger symbols
  - Suggested solution
    - Perceptual scaling to account for people's underestimation

Scaling with perception

- Perceptual / Psychological Scaling
  - Adjusts size to account people's underestimation
    - One common power function is the Flannery Scaling method (J.J. Flannery, 1971).
      - E.g., square root scaling to 0.57
    - Nonlinear scale



- Square symbols less sensitive to perceptual effects

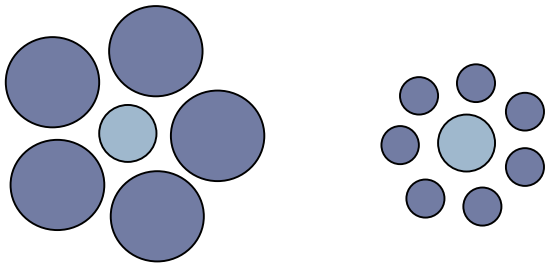
(The lower circle is increased by a power function using square root scaling to 0.57 to account for the user's underestimation of the change in areas.)

Group Activity

- Linear & Perceptual Scaling using ArcGIS
  - Download the dataset "proportional symbol.zip" from the BeachBoard and unzip to your own USB drive. You will see shapefile data of partial areas of LA County.
  - Open proportional symbol.mxd in the dataset in ArcMap.
  - Open layer properties window of sample_LACounty layer.
  - Go to Symbology tap > Quantities > Proportional Symbols.
  - See how the symbols are shown in different proportions in the map.
  - Check "Appearance Compensation (Flannery)" option in the Layer Properties window and see what happens in the map.

Scaling (cont.)

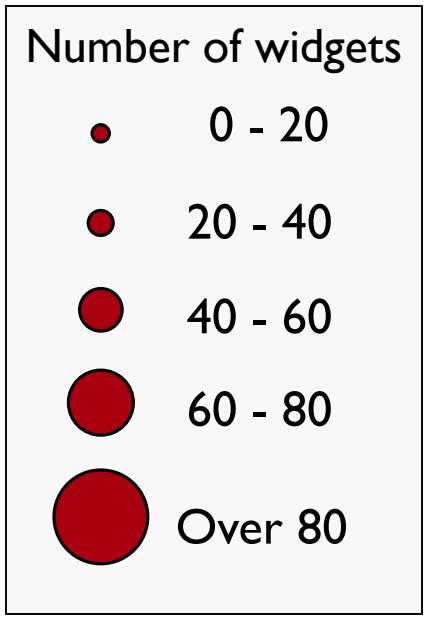
- Spatial context plays cognitive tricks on us
  - The Ebbinghaus illusion
  - Q. Which of the two circles in the center looks bigger?



- These problems suggest need for alternative solutions for comparison of different sizes of symbols

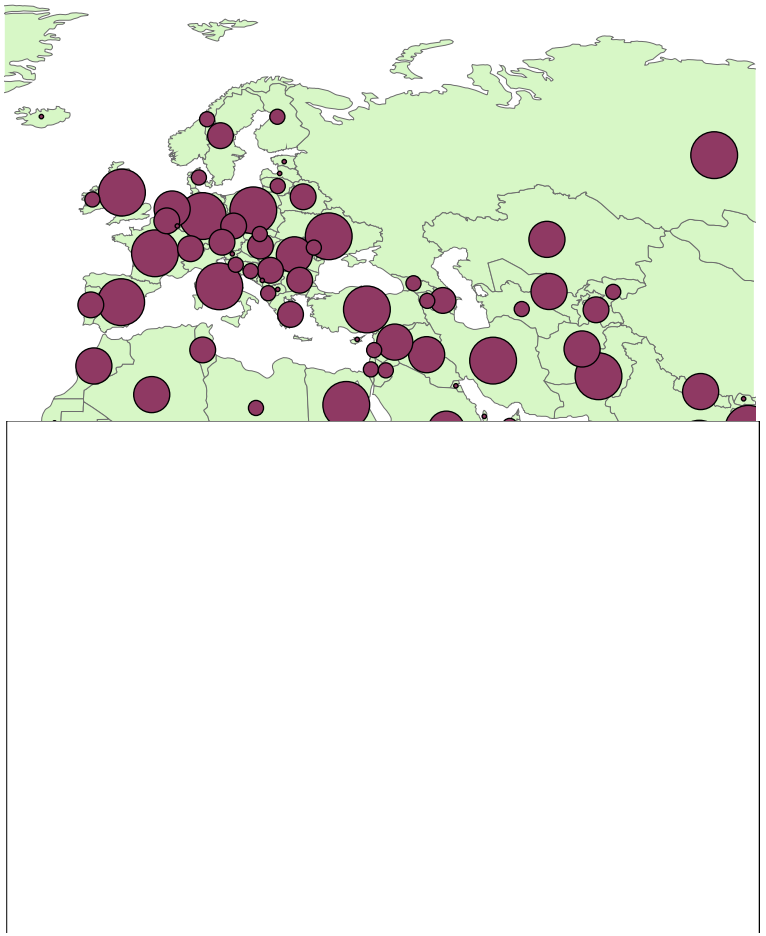
Scaling the symbols - classification

- Range-graded symbols can avoid the perceptual problem
  - E.g., choropleth mapping
- Divide data into groups or classes and represent them with symbols with different sizes
- Symbols only convey ordination, actual values (value ranges) found in the legend as labels



Geometric vs. pictographic symbols

- Geometric symbols
  - Easy to model size & quantity relationship
- Pictographic symbols
  - Intuitive to readers
  - Can get cluttered on the map



Summary

- Qualitative dot mapping
  - Visual variables for dots
- Proportional symbol and dot mapping
  - Size and placement of symbols
  - Perceptual issues
- Demonstration of dot-values and dot-size using ArcGIS

- Introduction to Term Project and Project Memo (PM) 1

Until next time…

- Reading
  - Ch. 11
- Term Project introduction
  - Due Oct. 30
- WS3
  - Due today
- Test2 on Nov. 6