



Data Generalization and Mapping



GEOG380 Fall 2018

Outline

- ▶ Scale and mapping
- ▶ Spatial data generalization



The actual map making

- ▶ **Decisions on**
 - ▶ Types of map (ch. 1&3)
 - ▶ Measurement, Symbolization (ch. 3&5) Design (ch. 11&12)
 - ▶ Projection (ch. 7&8)
 - ▶ **Generalization & Mapping – Today (ch. 6)**
 - ▶ Color (ch. 10)
 - ▶ Intellectual hierarchy (ch. 13)
 - ▶ Reproduction method, printing (ch. 13)



Implications of scale

- ▶ Watch the following slide and think about:
 - ▶ What happens to geographical objects in the map as the scale changes?
 - ▶ How does the change influence potential map-usages to understand the map?





A cartographic dilemma

- ▶ Smaller cartographic scales mean that map extent is (larger/smaller) area & detail, which leads to:
 - ▶ **Overcrowding & Collision**
 - ▶ Features (e.g., point and line symbols) require *more space than they do in reality* due to their sizes on the map
- ➔ Need for **generalization** to reduce complexity
- ▶ However, **should maintain**
 - ▶ Space & attribute accuracy
 - ▶ Aesthetic quality
 - ▶ Logical hierarchy



Generalization

- ▶ The process of **reducing** the amount of **details** on a map in a meaningful way
 - ▶ *“the selection and simplified representation of detail appropriate to the **scale** and/or the **purpose** of the map” (ICA, 1973)*
- ▶ The basic principle is to **emphasize** important things and **omit** less important things
 - ▶ Ensure readability
 - ▶ Preserve geographic context
 - ▶ Be faithful to reality
 - ▶ Avoid complexity (too much information)



Emphasized/ Omitted

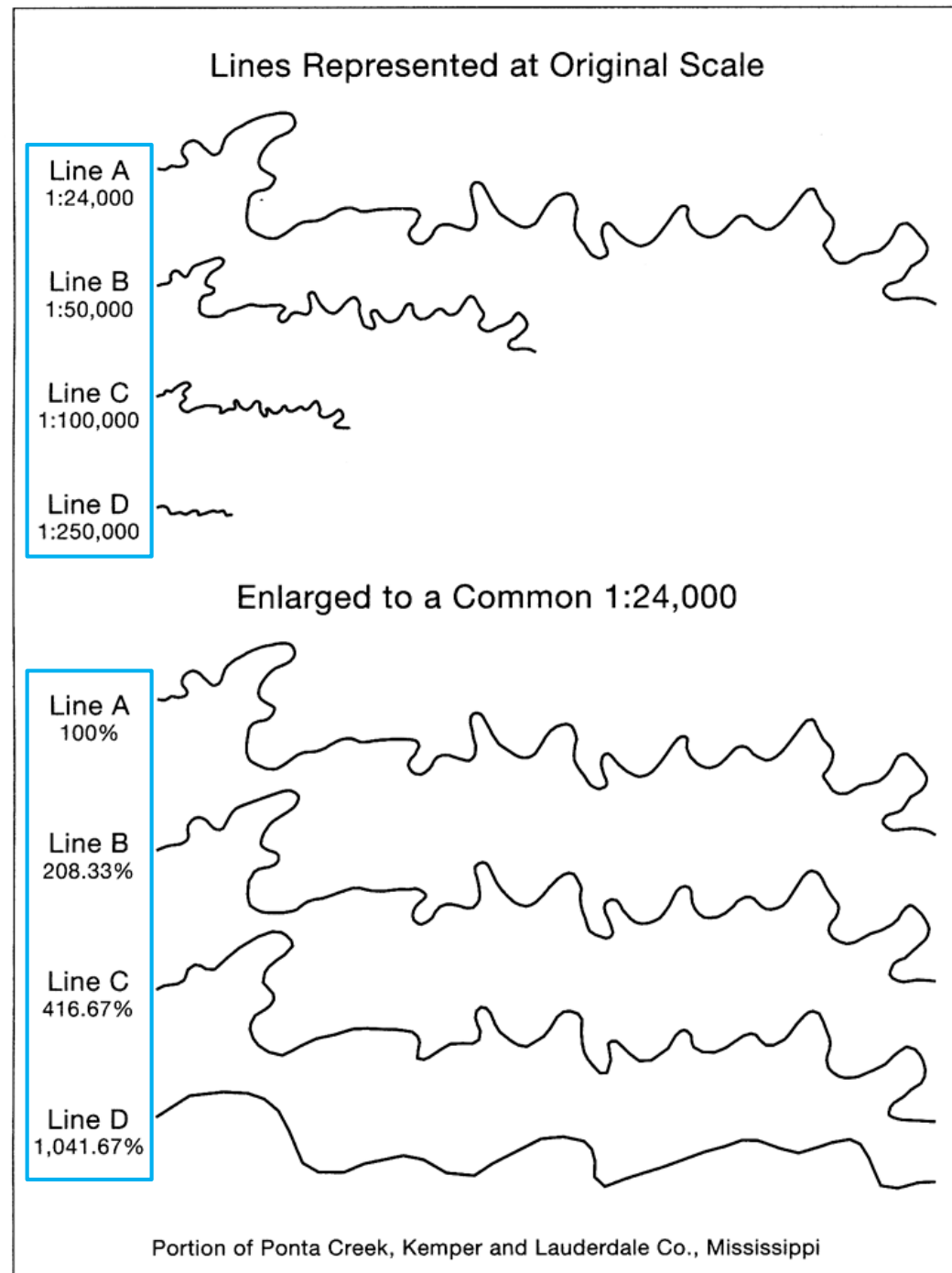


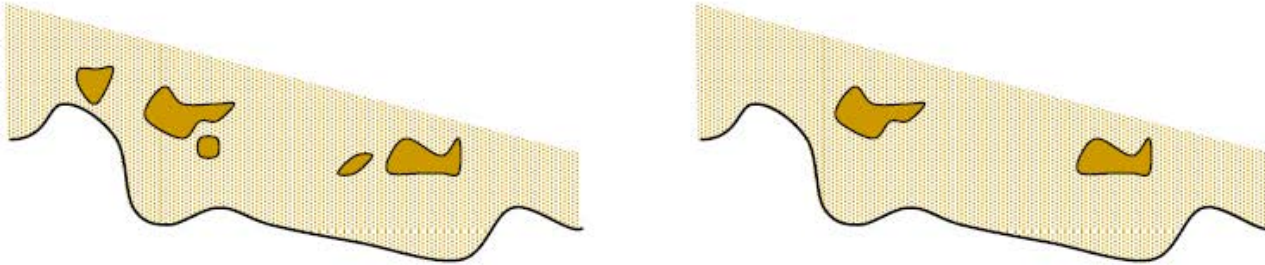
Figure 6.2 (Solcum et al. 2009)

Generalization operations

- ▶ Important: nomenclature is **not fixed** at present and these categories can be contested
 - ▶ Selection
 - ▶ Simplification
 - ▶ Smoothing
 - ▶ Displacement
 - ▶ Enhancement
 - ▶ Collapse
 - ▶ Merging
 - ▶ Classification

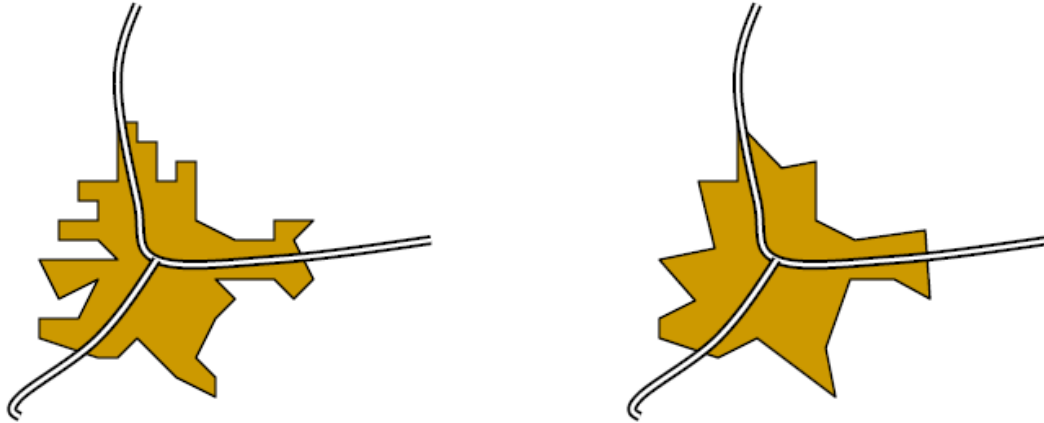


Selection



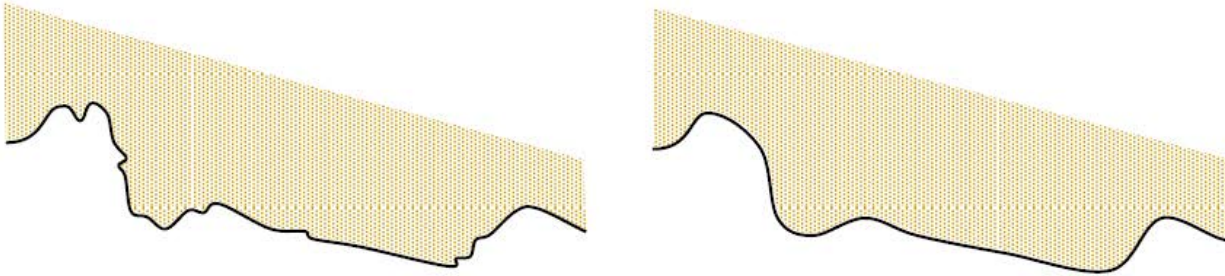
- ▶ Is the feature **necessary** to make your point?
- ▶ Will removal of the feature...
 - ▶ make the map harder to understand?
 - ▶ make more important features clearer?
 - ▶ make the map less noisy?

Simplification



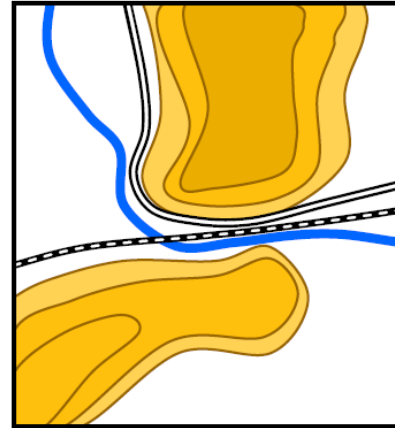
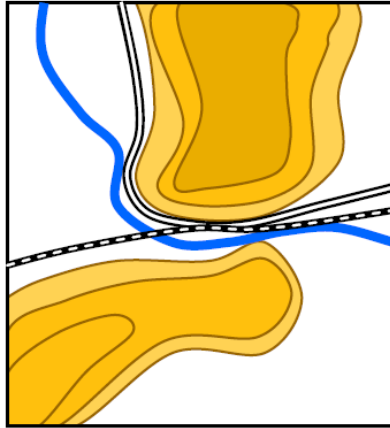
- ▶ Weeding out unnecessary details
- ▶ Can you simplify...
 - ▶ and still recognize the features?
 - ▶ without removing vital information?
 - ▶ and make features more noticeable?
 - ▶ and make the map less noisy?

Smoothing



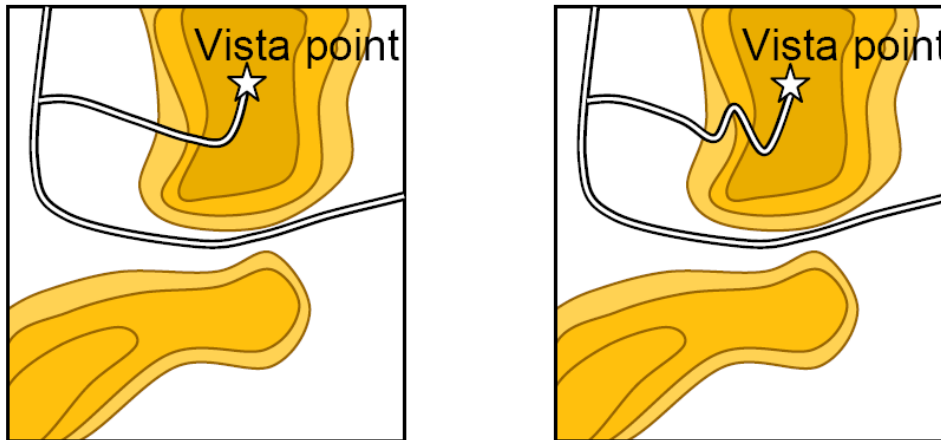
- ▶ Can you smooth a feature ...
 - ▶ without losing its character?
 - ▶ and still be able to recognize it?
 - ▶ and make the map less noisy?

Displacement



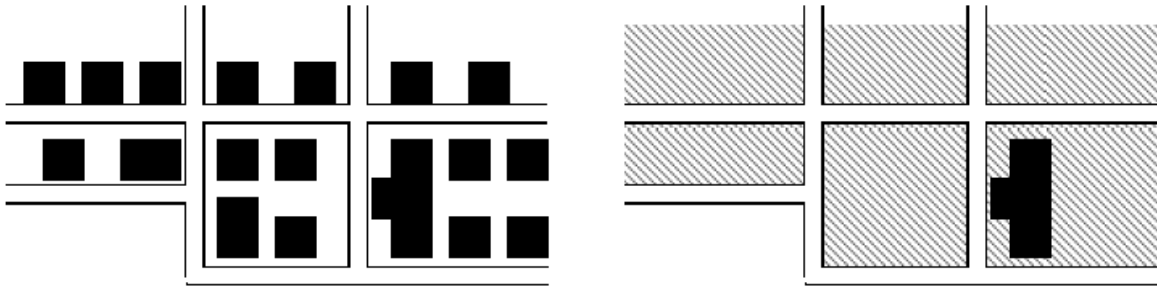
- ▶ Are features **interfering**?
- ▶ Will displacement ...
 - ▶ make features easier to distinguish?
 - ▶ lead to confusion because of the move?
 - ▶ make the map look less cluttered? (e.g., road maps)

Enhancement / Exaggeration



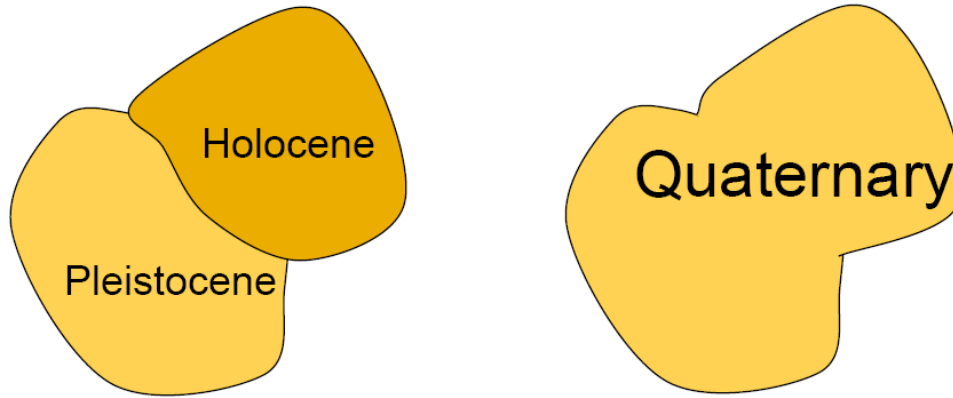
- ▶ Do you **know enough** to enhance a feature?
- ▶ Will enhancement ...
 - ▶ increase understanding?
 - ▶ make the feature easier to recognize?
 - ▶ possibly lead to **misunderstanding**?

Dimension change / collapse



- ▶ Does dimensional change ...
 - ▶ remove unnecessary detail?
 - ▶ affect **how features are understood**?
 - ▶ help to make the map look less cluttered?

Merging



- ▶ Keeping old classes creates too many/small units
 - ▶ Merge classes into new, **higher level classes**
→ **less number of classes**
 - ▶ Need to consider **the semantic hierarchy** of the symbols

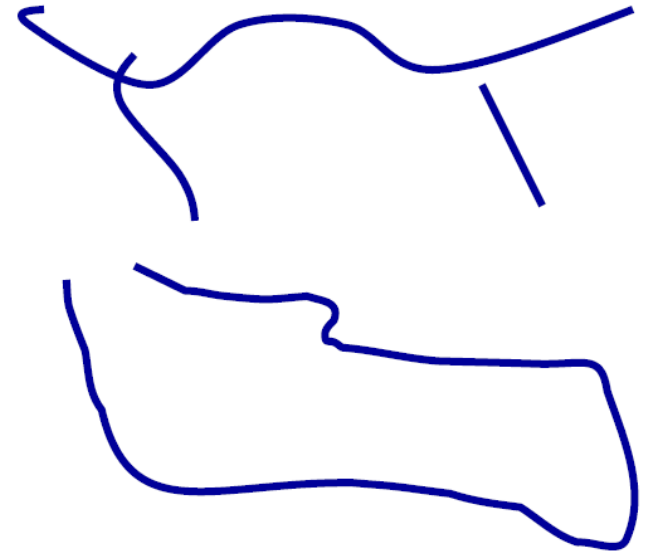
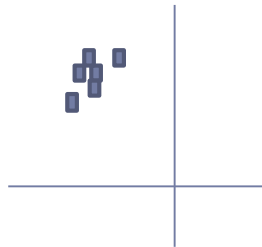
Group Activity: Simplification using MapShaper

- ▶ Launch the MapShaper (<http://www.mapshaper.org/>) in each tab and...
 - ▶ Download “08_shapefile.zip” from BeachBoard under Lecture Notes section, unzip the data to your USB drive. You will see several files under “shapefile” folder including “hydrology.shp”.
 - ▶ You can simplify your data by using a few methods through the website. To do so, first open your data by clicking on the “select” button in the “Edit a file” box and choose the “hydrology.shp” file (it has the largest size) in the “shapefile” folder in your USB drive. Keep the Important Options as the default. Hydrology data in a shapefile will be displayed in the user interface of MapShaper.
 - ▶ Click on the Simplify button and choose one of the *Simplification Methods*. Keep the other option as the default.
 - ▶ Drag the slider bar on the top to manipulate the degree of simplification of your data, and see how the data change.
 - ▶ Do the same thing for the other tabs in your web browser using different simplification methods and compare the results.
 - ▶ How they are different from each other?



Decide the level of generalization

- ▶ To deal with errors such as
 - ▶ Intersections where intended
 - ▶ Lines entered twice
 - ▶ Areas closed
 - ▶ Over and undershoots
 - ▶ Polygons too small, lines too close



Overgeneralization

- Data from **different sources** may have the problem

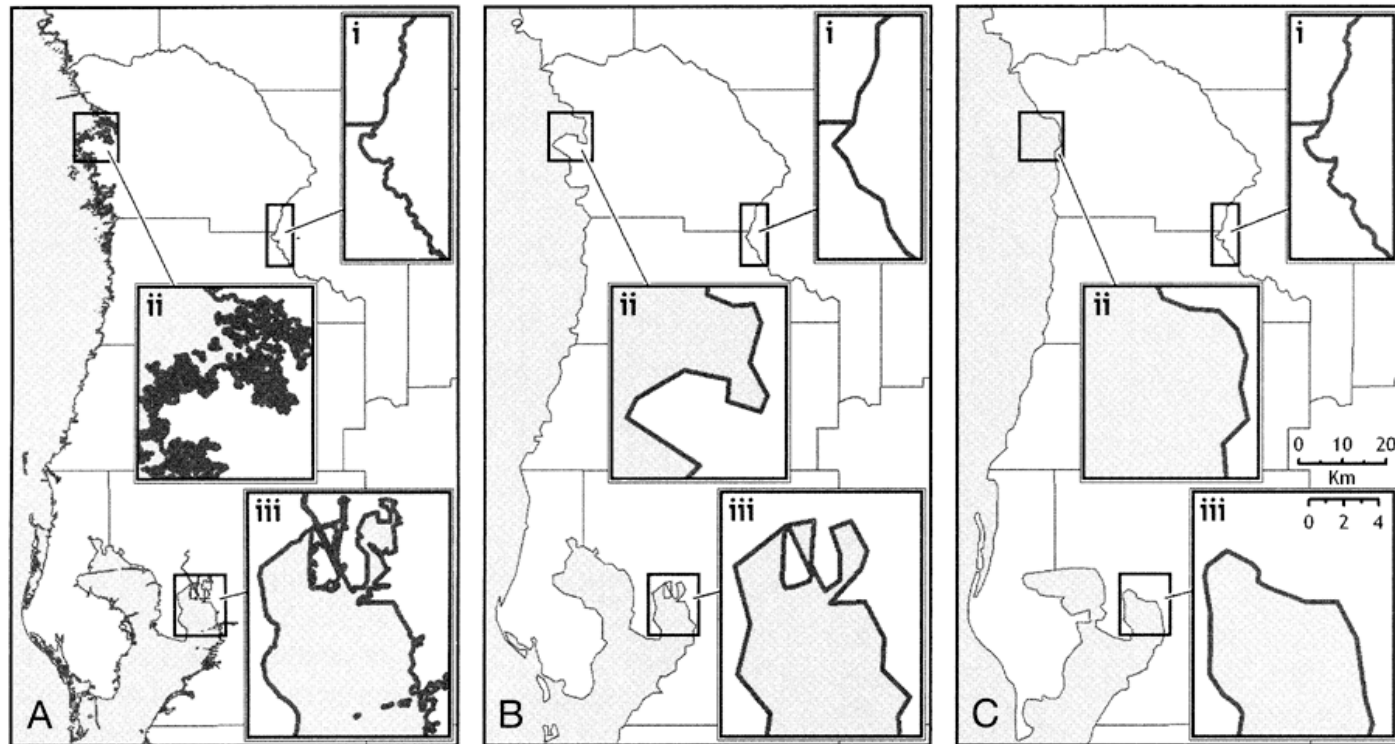


FIGURE 6.8 Generalization of the Florida Gulf Coast, assuming a target scale of 1:2,000,000: (A) the NHGIS raw data (based on USGS digital data at a scale of 1:150,000); (B) an NHGIS-produced generalization; (C) a generalization produced by the U.S. Bureau of the Census. (Courtesy of the International Cartographic Association.)

Generalization in several dimensions

- ▶ There is a **cognitive part** to this as well!
 - ▶ Generalization is often a **holistic combination of several operations**, previously done *unspecified* in the head of the cartographers
- ▶ Conceptual / Semantic generalization
 - ▶ Needs **expert knowledge** about themes/features on the map
 - ▶ E.g. **classification** of data (*next*)
 - ▶ Recall the “merging” example...



E.g. **classification** of data (cont.)

- ▶ A way of generalization or simplification in which **details are lost**, but we can **structure the message** for better communication
 - ▶ Ex. Land-use and land-cover (LULC) classification system
 - ▶ Detailed: Primary Forest, Swamp Forest, Secondary Forest, Rastrojo (Early Secondary Succession), Pasture with No Trees, Pasture with Few Trees, Pasture with Many Trees, Coffee, African Palm, Palmito, Cacao, Banana, Corn, Barren, Urban, Water
 - ▶ Generalized: Forest, Agriculture/Pasture, Urban/Barren, Water, Unclassified
 - ▶ Reference: Anderson et al. (2001). A Land Use And Land Cover Classification System For Use With Remote Sensor Data. Geological Survey Professional Paper, 964
<http://landcover.usgs.gov/pdf/anderson.pdf>



Group Activity

- ▶ Make a group of 3-5 people around you.
- ▶ Find another example of classification of data including a generalized class and more than two detailed classes of the generalized class. Any categories of classification can be used. Refer the previous slide for examples.
- ▶ Share your group's finding with others.



For next time

- ▶ Readings

- ▶ Ch. 6
- ▶ Ch. 7 & 8 (Map Projections)

- ▶ Sep. 25

- ▶ **Test I** (at the beginning of class): lecture notes #01~07
 - ▶ Study guide & sample questions on the BeachBoard
- ▶ **WS2** (due in class)

