Preparing Effective Maps

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What makes a map communicate accurately, clearly, and persuasively?

Considerations in Preparing a Map

Spatial aggregation
- Determine the appropriate spatial level to display (e.g., state, county, tract, block group, town, ZIP code)

Data processing
- Data extraction and adjustment
- Covered in database and census lectures
- Often a substantial task

Classification of data
- Organizing data for display

Symbolization
- Deciding how to represent features

Other elements of a map
- Features to improve readability and clarity

Map as a Graphical Tool for Presenting Information

Maps "tell a story"

The story may change depending on the items listed above

Data Processing and Normalization

The data you need may not be available in
Raw counts need to be adjusted for variations in:
- land area
- total population
- total housing units
- others

Converts **magnitude** data (counts, sums) into **intensity** data (rate, percentage, average)

Examples:

Magnitude	Intensity
Population of a census tract	Population / area of tract = population density of a census tract
Count of housing units in a block group	Housing units / area of block group = housing density of block group
Vehicles available in a census	Vehicles available / occupied housing units = average

tract	vehicles per occupied housing unit

Data Classification

Classification is key to producing understandable maps that people can interpret readily

Classification can strongly affect the apparent results

Guidelines for classification:
- Policy relevant (e.g., incorporating poverty line in household income map)
- Scientifically meaningful (e.g., carrying capacity)
- Informative

How many classes?
- From 2 to 5 ranges work best
- The most common number is 5
- Related to symbolization (e.g., color vs. graytone)

Classification Methods Used by ArcView

Tip: For ArcView's explanations of its classifications methods, search for "natural breaks" in the topics index in the online help. The page that appears shows ALL the classification methods.

(1) Quantile (Equal Count)

assigns (roughly) equal number of cases to all categories

provides a balanced image

puts very different values together -- covers outliers and thresholds

the break points may not be policy relevant or scientifically meaningful

(2) Equal Interval Classification

classifies according to data values with equal interval

is easy for map user to understand

tends to produce unbalanced map image (can produce empty categories)

break points may not be policy relevant or scientifically meaningful

(3) Natural Break Points

look for "naturally" occurring groupings in the data

internal homogeneity for each class

(4) Standard Deviation

distance from the mean

statistically sound

(6) Equal Area

break points determined by polygon areas

attempts to have equal total area of polygons in each group

(5) User-Defined classification

gives freedom to determine the break points

possible to make the break points meaningful

difficult for the reader interpret the map

harder to justify

Symbolization

Three geometric categories of map symbols:
- points (zero-dimensional objects)
- lines (one-dimensional objects)
- areas (two-dimensional objects)

Complexity (scale factor)
- e.g. cities as points in small scale maps

Visual Variables

Described by Mark Monmonier in How to Lie with Maps
1st ed.: Chicago: University of Chicago Press, 1991
2nd ed.: Chicago: University of Chicago Press, 1991

Size
- radius of circle
- width of line
- area of a shape
- *best for describing magnitude data*

Shape:
- effective for showing qualitative differences (e.g., a school vs. a church; forest vs. water)

Graytone value:
- effective for describing intensity data (percentage of low income; population density)

Texture:
- effective for showing both qualitative and intensity differences
- effective for producing easily reproduced black-and-white maps, but are often hard to read and interpret

Orientation:
- effective for showing flows
- (e.g., migration flows; traffic flows)

Hue (color):
- effective for showing both qualitative and intensity differences

General Rules for Symbolization

Selection of symbols should be based on:
- logic (order/sequence in size, color, graytone)
- common perception/convention
  - Example:
    - blue for water, green for plants
- visual clarification

Important to remember:
- use graduated-point symbols indicate **magnitude**
- use graytones or colors indicate **intensity**

Data aggregation

Different areal aggregations may yield very different patterns

Basic rule:
- start with disaggregated data whenever possible

Other elements of a map

Title and labels:
- informative title: precise and concise
- label: naming and signifying features

Scale:
- the choice of scales (e.g. regional planning vs. site design)
- different type of scales (graphic scale as strategy against distortion)
- drawing a scale bar in MapInfo

North Arrow:
- orientation of the map

Legend:
- show class breaks
- clearly and accurately corresponding with symbolization

Map projection:
- Equal-area vs. conformal (angle-preserving)
- Projection pages by Peter H. Dana

What should we remember?

Keep in mind the basic rules of cartography
Take advantage of the computer technology to explore data and refine maps
Verify your conclusions or outcome with good knowledge of the place and subject matter
As map maker, don't lie with maps
As map user, don't get misled by maps that lie
Be creative but careful

These notes are based notes prepared by Qing Shen for a lecture he gave to 11.208 during January 1997. Thanks to Jennifer Johnson for suggestions on this material.