Basic principles of cartographic design

Makram Murad-al-shaikh
M.S. Cartography
Esri education delivery team
Cartographic concepts

- Cartography defined
- The communication channel
  - Why maps fail
- Objectives & limitations affecting design
- Cartographic design issues
- Abuse of GIS cartography
What is cartography?

- Art
- Science
- Technology
- Making maps
- Presentation
- Use

Map
How do I communicate through maps?

The geographic environment

Compile

Recognize

Select

Classify

Simplify

Symbolize

Read

Analyze

Interpret

Imagine

Map

Cartographer

Map user

Reality

Reality?

Map
What is cartographic design?

Complex task (unlimited options)

Highly creative mental activity

Use concepts of communication

Think in visual terms

Useful map

Beauty is NOT the MAIN objective
What are my cartographic objectives?

- **The WHY?**
  - Map objectives
    - Convey information
    - Highlight spatial relationships
    - Illustrate analysis results
    - Easier comprehension of complex events
  - Design objectives
    - Fulfill map objectives
    - Assign meaningful symbology
    - Ensure truthful depiction of reality
    - Fulfill communication objectives
What are my communication objectives?

**General map**
- Variety of information
- Equal importance
- Subtle symbology

**Thematic map**
- Focused information
- Importance can vary
- Symbols can dominate

- Soils
- Population
- Qualitative
- Quantitative
Which projection should I use?

- More than 4000
- No perfect projection
- All have distortions

Cylindrical
Conical
Azimuthal
How much detail should I include?

- Omit?
- Aggregate?
- Collapse?
- Simplify?
- Displace?
- Typify?
- Refine?
- Classify?
- Exaggerate?
What symbol characteristics should I use?

**Qualitative**
- Color
- Shape
- Texture / Pattern

**Quantitative**
- Graytone value
- Size
What colors should I use?

- Connotations
- Conventions
- Preferences
- For screen or paper
Does the eye have limitations?

Maximum 12 colors

Maximum 7 – 8 shades
What about the color-impaired?

- Avoid pure green / red
- Vary shapes, textures
- Use brightness contrast (not more colors)
Can I used special effects?

- Texture
- Vibration
- Optical illusions
- Orientation exerts direction
When do I use patterns?

- Only for areas
- Qualitative symbology
- Consider effects of reduction
How legible are my symbols?

- Size of symbol
- Distance of viewing
- Perfect vision?
How do I create visual contrast / hierarchy?

Differentiation

Relative importance
How do I contrast text on maps?

- **Legibility issues**
  - Text color vs background color
  - Uppercase vs lowercase
  - No fancy fonts
Where do I place names at POINTS?

- Readability issues
Where do I place names along LINES?

- **Ambiguity** issues
How do I label contours?

- Faster reading issues

Maplex
What angles are suitable for names?

- Convenience issues
What map elements should I place on my map?

- Projection?
- Source?
- Date of data?
What is visual balance?

- Layout of map elements
- Visual center

- Visual weight
  - Size, value, brilliance, close to edge
- What about gaps?
Which of these maps is more visually balanced? TEST 1

A

1

B

2

C
Which of these maps is more visually balanced? TEST 2
Which of these maps is more visually balanced?  TEST 3
Is North correct everywhere?
What about my scale?

Are these dog houses?

Must be visually easy to read

Is it correct?

Is it easy to use?
What about my legend?

Necessary?

Decimals?

% of total population over 18 years old

- 59.316 - 69.813
- 69.814 - 72.431
- 72.432 - 75.435
- 75.436 - 79.148
- 79.149 - 87.405
What about maps for publishing in ArcGIS Online?

• Cartography vs performance
  • Avoid
    - Advanced Drawing Options in ArcMap
    - Multiple layer symbols
    - Picture symbols
    - Dash line patterns, splining, and offsets
    - Dot density fills
    - Text halo masks and text fill patterns
    - Complex SQL statements for text
  • OR publish the map as a cached map service
Always Think of the User
Where can I read more about cartographic design?


Okabe, Masatake and Kei Ito. *How to make figures and presentations that are friendly to color blind people*, Aug. 2002.