Cartographic visualization

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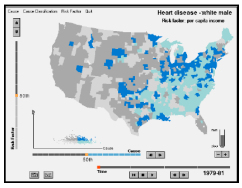
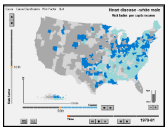
So… what is it?



- Which of these is a cartographic visualization?

Different maps, same domain

- Visualization methods for interacting with geographic information (MacEachren, 1998)
- Applying cartographic principles to visualization of non-geographic information (Skupin, 2000)



Why cartographic viz?

- Dynamic, interactive visualization of geospatial information
  - F+C, linked highlighting, fluid navigation…
- Spatial visualization of non-geospatial data
  - Cartographic principles

Papers

- Cartographic Perspectives on Information Visualization (Skupin, 2000)
- Where on Earth is the Internet? (Dodge & Shiode, 1998)
- HealthVis (MacEachren et al., 1998)

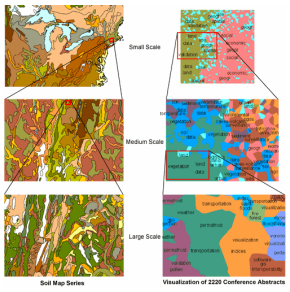
Map metaphors for non-geo data

- Timeline
  - Late 1800's: Intellectual domains (Otlet)
  - 1980's: Early hypertext systems
  - 1990's: Mapping/spatial metaphors in infoviz
- Cartographic principles rarely applied
  - "Readings in Infoviz": 3 references

Scaling

- "The major usability problem"
- Tradeoffs between:
  - Number of features
  - Size of symbols
  - Size of display area
- Cartographic generalization:
  - Preserve meaning at different scales

Example



Projection

- Cartography: 3D->2D
  - Mercator: angular relationships (directions)
  - Peters: relative area
- Infoviz: nD->2D
  - Multi-dimensional scaling (MDS): distance
  - Self-organizing maps (SOM): topology

Labeling

- Infoviz issues:
  - Space, label positions, label terms
- Cartography
  - Conventions to deal with these issues
    - Coastal cities vs. cities near the coast
  - Labels can add meaning to features
  - Labels can help in evaluating visualizations
    - Terrain visualization with only ridges labeled?

Paper critique

- Strong points:
  - Good overview of related issues/ideas in cartographic research
  - Many basic cartographic references
- Weak points:
  - Few specific guidelines
  - No examples of actual systems
  - When do these ideas not apply?

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Where on Earth is the Internet?

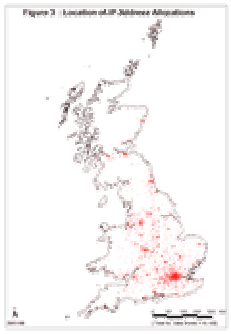
- Internet typically perceived apart from real-world geography
- Map Internet "real estate" onto real geospace
  - Where are domains actually located?
- Possible impacts on cities/areas with high concentration?

Dataset

- Domain registration records
  - Not geographically referenced
  - But contain physical contact information
  - Postal codes extracted, mapped to location
  - Also IP address allocation for each domain
- Entire UK domain registry as of 1997
  - 10,183 records
  - 44 million allocated IP addresses

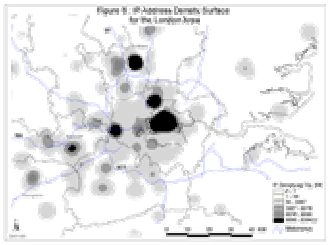
Visualization 1

- Density surface map
- Dot = record
- No context, low information density



Visualization 2

- IP address density, more context



Paper critique

- Strong points
  - Map metaphor for non-geographic data
  - Real-world dataset
- Weak points
  - Accuracy: IP allocation vs. actual use
  - No interaction/navigation/filtering
  - No time component
  - No evaluation

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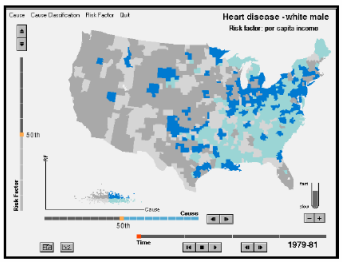
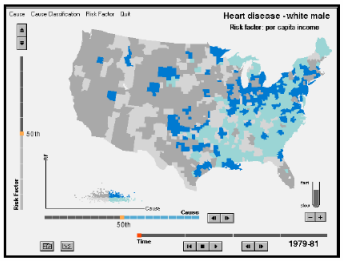
HealthVis

- Exploratory map-based visualization of variations in health statistics
  - Death rates for various causes, risk factors
- Goal: Spatial and temporal analysis
  - Spatial: easily find regions/clusters
  - Time: compare changes over time
  - Space+time: trends in regions/clusters over time

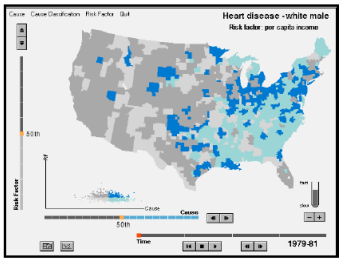
Linked views



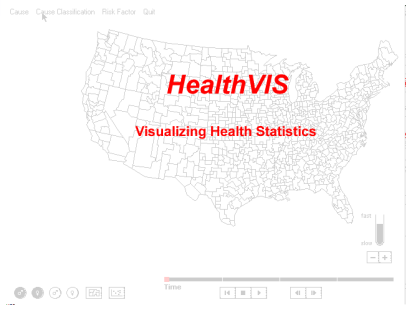
Cross map



Animation for time series



Demo



Evaluation

- Task-based exploration with domain experts
- Results:
  - Spatial tasks easy with linked highlighting
  - Animation good for noticing time trends
  - Space+time trends more difficult

Paper critique

- Strengths:
  - Good analysis of issues in multivariate geographic data exploration
  - Real dataset
  - Detailed qualitative evaluation
- Weaknesses:
  - Dense, some unclear terminology
  - Effectiveness of cross maps?
  - Evaluation focused on task, not system

Questions?