Scalemaster: Multi-Scale Mapmaking from Multiple Database Resolutions and for Multiple Map Purposes

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ScaleMaster

Understand workload balance between

- **display** change (select, eliminate, symbolize)
- **geometry** change (simplify, aggregate, displace, collapse…)

Complement to European MRDB research

- reviewed in Brewer & Buttenfield (2007) in CaGIS
ScaleMaster

Understand workload balance
- using databases with different resolutions
- through a continuous range of scales
- for varied map purposes (topographic, zoning, soils, population)

Return to diagram details later…
Project context

Ada County government (Boise Idaho) ↔ ESRI
- clean an existing 1:5,000 base map database
- topographic and special purpose map products
- mapping scales 5K and smaller

1:5K and 1:1M map segments
Project context

Work that happens at CU-Boulder

- geodatabases for ScaleMaster
  - edit, clean and attribute Ada County data
  - create smaller scale geodatabases (Python, ModelBuilder)
    akin to LoDs (level-of-detail preprocessed databases)

See Buttenfield & Frye paper in *ICC2007 Proceedings*
Map examples at 1:5K, 15K, 30K, 100K, 200K, 700K
Example topo map at 1:30K from 1:5K data

RA Jess Acosta’s map sets:
Example topo map at 1:30K from 1:5K data

RA Jess Acosta’s map sets:
Designed for onscreen display
Prepared using ArcGIS 9.2 and Maplex (no convert to annotation)
Different map purposes with same base data

1:30K maps from 1:5K data
Different map purposes with same base data

1:30K maps from 1:5K data
Different map purposes with same base data

Topo
Zoning
Soils
Population density
ScaleMaster: Topographic Mapping

Hydrography:
- Hydro areas
- Hydro lines
- Hydro points
  - Areas
  - Lines

Physical:
- Summits
- Hillshade
- Vegetation
  - Summits
  - Landforms

Transportation:
- Roads

1:5K to 1:1M

Feature types grouped along vertical axis (hues)

Horizontal axis is log of scale

Low tech...Excel page
Symbols – wide bars
Labels – thinner bars
Bars extend through range that symbols/labels for feature are present
Geometry change marked by lightness change

features off map
14 types of design decisions for scale change

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td>size change*</td>
</tr>
<tr>
<td>c</td>
<td>color change*</td>
</tr>
<tr>
<td>p</td>
<td>pattern change (e.g., dash, crosshatch)*</td>
</tr>
<tr>
<td>t</td>
<td>transparency change*</td>
</tr>
<tr>
<td>l</td>
<td>modify label appearance (e.g., bold, italic, character spacing, leading)</td>
</tr>
<tr>
<td>i</td>
<td>improve label positions in relation to nearby features or labels (e.g., overrun, remove duplicates, feature weighting)</td>
</tr>
<tr>
<td>o</td>
<td>on/off for aspect of symbol or label (e.g. remove outlines for areas with feature type still present)</td>
</tr>
</tbody>
</table>

* visual variables
14 types of design decisions for scale change

r – **reclassify** features by attribute (e.g. fewer categories)

f – **filter** by threshold on feature attribute (e.g., filter on size to remove small parks)

e – **eliminate** layer or eliminate by feature type (e.g., eliminate intermittent streams)

a – **add** layer or add by feature type (e.g., add labels for physiographic features classed as large)

x – change **layer order** in TOC (e.g., roads moved from beneath transparent area to above)

R – use **Representations** tools (e.g., set endings of dashes with full pattern)

G – **geometry** change (e.g., new data set or new layer with generalized features)
Procedure:
Design individual maps working randomly through scales, starting as new project on each, with same geodatabase, then examine designs in series.

Jess' designs:
Procedure:

Design individual maps working randomly through scales, starting as new project on each, with same geodatabase, then examine designs in series.

Jess' designs:

Total 122 map projects
Four map purposes at 1:150K

Topo

Soils

Zoning

Population
Potential as a GIS map design tool… ScaleBrewer?
Potential as a GIS map design tool… ScaleBrewer?

Click here to see styled feature set: e.g., roads with line styles by class.
Potential as a GIS map design tool…
ScaleBrewer?

Click here to see processing detail: e.g., aggregation tolerances in LoD
Potential as a GIS map design tool… ScaleBrewer?

Select to deliver:
- Table of specs
- .style file, .lyr file
- OGC SLD spec
Summary

Workload balance between

– **geometry** changes (simplify, displace, collapse, aggregate…)
– **display** changes (symbolize, select and eliminate)

You can design through an **entire** scale range with

– few data captures
– key geometry pairs (e.g., centerlines that correspond to polygons)
– few LoDs for sensitive feature types (e.g., hydrography)
Next steps

How general is ScaleMaster?

- Examine distributions of types of change through scale
  - assist design decisions
  - assist data download choices

- Establish effective workload that minimizes geometry change
  - reduce layer integration burdens
  - reduce processing time
  - different (cheaper) worker skills
Next steps

How general is ScaleMaster?

– Determine where preprocessed LoDs and new data captures most needed
  • reduce workload/cost
  • assist decision to incorporate others’ existing datasets (are data close enough to be considered redundant scale?)
Regular research meetings

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in Redlands

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