How Maps Work
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An introduction to some fundamental cartography…

Importance of design

The purpose of making a map

Aspects of map design:
  - hierarchy
  - contrast
  - figure-ground
  - projections
  - symbols
  - generalization
  - colour
  - typography

Putting the pieces together

Review / iterate / improve

…to help you become a smarter cartographer
Importance of Design
compromise
ART
opportunity
GRAPH
why?
Design is crucial to communication

- Large database
- Equal Treatment
- No inherent design

Design

- Data Processing
- Function
- Meaning
The design process

- Identify map problem
- Initial ideas
- Refine ideas
- Build a draft/prototype
- Test and decide on final design
- Map production
- Map use
Why make the map?
What’s the story?
Speaking in graphical tongues

Written/spoken word: SERIAL

Graphics: PARALLEL
Audience
Media resolution
Viewing distance
Output medium
Anticipated level of understanding
Conditions of use
One map or multiple maps
What areal extent to show
Insets/multiscale
Demo: Requirement
Aspects of Map Design
Demo: Hierarchy
Projections
WGS 1984 Web Mercator (Auxiliary Sphere)

ArcGIS Online
Bing
OSM
Google
Demo:
Projections
Symbol palette

- **Spacing**
  - Various line styles and distances

- **Size**
  - Different circle sizes

- **Shape**
  - Various shapes and symbols

- **Orientation**
  - Arrow styles and directions

- **Hue**
  - Color options for lines and shapes

- **Lightness**
  - Gradient fills and color variation
### Symbol meaning

<table>
<thead>
<tr>
<th>Points</th>
<th>Lines</th>
<th>Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport</td>
<td><strong>Motorway</strong></td>
<td>Forest</td>
</tr>
<tr>
<td>Emergency Phone</td>
<td><strong>Railway</strong></td>
<td>Agricultural</td>
</tr>
<tr>
<td>Picnic site</td>
<td><strong>River</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Nominal</strong></td>
<td><strong>Canal</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td><strong>Motorway</strong></td>
<td><strong>Large</strong></td>
</tr>
<tr>
<td>Medium</td>
<td><strong>A road (dual)</strong></td>
<td><strong>Medium</strong></td>
</tr>
<tr>
<td>Small</td>
<td><strong>A road</strong></td>
<td><strong>Small</strong></td>
</tr>
<tr>
<td><strong>Ordinal</strong></td>
<td><strong>B road</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Minor</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 - 999</td>
<td><strong>30 - 39</strong></td>
<td><strong>40 - 49</strong></td>
</tr>
<tr>
<td>100 - 499</td>
<td><strong>20 - 29</strong></td>
<td><strong>30 - 39</strong></td>
</tr>
<tr>
<td>0 - 99</td>
<td><strong>10 - 19</strong></td>
<td><strong>20 - 29</strong></td>
</tr>
<tr>
<td></td>
<td><strong>0 - 9</strong></td>
<td><strong>10 - 19</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>0 - 9</strong></td>
</tr>
<tr>
<td><strong>Interval or Ratio</strong></td>
<td></td>
<td><strong>%</strong></td>
</tr>
</tbody>
</table>
Demo: Symbols
Feature generalization

Small scale

Large scale

1:147,914,382
1:577,791
1:72,224
1:18,489,298
1:144,448
1:4,514
No generalization | Generalized

Simplify

Smooth

Aggregate

Amalgamate

Collapse

Sample points ➔ Sample areas

Individual small areas ➔ Clustered to larger area

City ➔ Geometric & mimetic symbol
No generalization | Generalized

**Merge**
- Railway sidings
- Track represented by new lines

**Refine**
- Stream order in watershed
- Only portray 1st & 2nd order streams

**Exaggerate**
- Bay
- Inlet
- Widen mouth of inlet

**Enhance**
- Roads cross
- Major road crosses minor road
- Displace Junction to avoid appearing to cross

**Displace**
- Roads don’t cross
Classification
Demo: Generalization
Colour – qualitative
Colour – sequential
Colour – diverging
Typography

Size

5 point 7 point
10 point 12 point
18 point
24 point

Position

CITIES
Towns
villages

Conflict

Style

sans serif serif
Demo: Typography
Putting pieces together
San Diego Walking Map

Legend
- Green: Walk
- Red: Bike
- Blue: Accessible Walk

San Diego Walking Map
Demo: 2D/3D layout
Review the outcome
One more thing

Actually... a few more things
Cartography.
The book (Nov 2017)
esripress.esri.com
Cartography.
The MOOC
esri.com/mooc/cartography  (Nov 2017)
Other sessions

How maps work (KF/WJ)  Tue 15:15 | Thu 13:30
Amazing and Inspiring maps (KF/JN)  Tue 08:30 | Wed 10:15
Thematic map design (KF/JN)  Tue 13:30 | Fri 09:00
3D Cartographic Techniques (NS/KF)  Wed 13:30 | Thu 15:15
Map Design for relief representation (KF/JN)  Wed 08:30 | Thu 10:15
Designing Story Maps to Change Hearts & Minds (JN/JB)  Tue 10:15
Designing Esri’s Vector Tile Basemaps (WJ/AS)  Tue 14:00 | Wed 12:00
Styling Vector Basemaps (WJ/AS)  Thu 10:15
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