How to Make a Great Map

Kenneth Field and Wesley Jones
"Cartography is the discipline dealing with the art, science and technology of making and using maps."

Meno-Jan Kraak
President of the International Cartographic Association

"Traditionally, map making is graphic rendering of phenomena or relations on the earth. Now the term is expanded to general biobjective representations of spatially distributed relations. For example genetic maps."

Waldo Tobler, deceased
Professor Emeritus at the University of California, Santa Barbara

"Cartography, to me, is the art and science of simplifying the real world around us to tell a story using pictures."

Ed Parsons
Geospatial Technologist of Google

"Cartography is the thinking that leads to smarter mapmaking."

Kenneth Field
Professional cartonerd
Cartography as a language
Compromise

Oportunity

Y why?
Serial, linear

Parallel, non-linear
Some principles of map design

1. Concept before compilation
2. Hierarchy with harmony
3. Simplicity from sacrifice
4. Clutter to clarity
5. Emotion expresses, engages, and elucidates
The design process

1. Identify the map problem and need
2. Sketch out initial ideas
3. Make a draft or a prototype
4. Share, refine and iterate
5. Map production
6. Map use
7. Test, seek feedback and decide the final design
Wireframing and Storyboarding
Constraints

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
A Taxonomy of Ideas
Structure + Functionality + Unpredictability?

By David McCandless informationisbeautiful.net
Wes, what’s the map?
San Diego Walking Map

Legend
- Eventual walk
- Main walk
- Museum's walk
Design hierarchy
Hierarchy, contrast and figure-ground
Wes, what’s hierarchical in the map?
Design
projections
Wes, have you considered projections?
Design symbols
During the 1975-1976 Brian Clough years, Nottingham Forest went from champions 1st to relegation.

During this period they won runners-up. They went 42 unbeaten between Nov 1977 and Dec 1978, a record that stood until 2004.

YOU ARE HERE

Hamburg
Berlin
Frankfurt
Munich
<table>
<thead>
<tr>
<th>Feature dimension</th>
<th>Qualitative</th>
<th>Quantitative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Encoding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td></td>
</tr>
<tr>
<td>Literal</td>
<td>airport, stadium, factory</td>
<td>8 ton, 100 people, 20 births</td>
</tr>
<tr>
<td>(words, numbers)</td>
<td>small, medium, large</td>
<td>100 people, 1.3 births per family</td>
</tr>
<tr>
<td></td>
<td>City</td>
<td>Nottingham 100k—500k</td>
</tr>
<tr>
<td></td>
<td>River</td>
<td>Newark 10k—50k</td>
</tr>
<tr>
<td></td>
<td>Monument</td>
<td>superstore 0—9k</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nottingham 311,800 people</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Newark 27,700 people</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stansted 1,978 people</td>
</tr>
<tr>
<td>Multiple</td>
<td>City</td>
<td></td>
</tr>
<tr>
<td>Point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(geometric, pictorial)</td>
<td>airport, emergency phone, picnic site</td>
<td>Value</td>
</tr>
<tr>
<td></td>
<td>Shape &amp; Hue</td>
<td>Value</td>
</tr>
<tr>
<td></td>
<td>international airport, regional airport (disused)</td>
<td>Shape &amp; Value</td>
</tr>
<tr>
<td></td>
<td>train, boat, plane</td>
<td>units sold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1st quarter, 2nd quarter</td>
</tr>
<tr>
<td>Feature dimension</td>
<td>Encoding</td>
<td>Qualitative</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nominal (difference)</td>
</tr>
<tr>
<td><strong>Line</strong></td>
<td>Single</td>
<td>Shape &amp; Hue, Shape &amp; Value</td>
</tr>
<tr>
<td></td>
<td>Multiple</td>
<td>Railway, River, Road</td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td>Single</td>
<td>Shape &amp; Hue, Hue, Shape &amp; Arrangement</td>
</tr>
<tr>
<td></td>
<td>Multiple</td>
<td>Building, Forest</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size &amp; Orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>by Air, by Road</td>
</tr>
<tr>
<td>Feature dimension</td>
<td>Encoding</td>
<td>Qualitative</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
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</tr>
<tr>
<td>Volume</td>
<td></td>
<td>Hue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nominal (difference)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vote A, vote B, vote C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency</td>
</tr>
</tbody>
</table>
Wes, how did you design the symbols?
Design generalisation
Feature generalization

Small scale

1:147,914,382
1:18,489,298
1:144,448
1:4,514

Large scale

1:577,791
1:72,224
1:144,448
1:4,514
Wes, how about generalisation?
Design colour
Qualitative
Four colour

Four-colour theorem applied to the United States. No two adjacent States have the same colour which creates a well balanced distribution of colours across the map.
Wes, how have you used colour?
Design typography
<table>
<thead>
<tr>
<th>Use</th>
<th>Description and Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptive text</strong></td>
<td>Reflects features that are symbolised on map by point, line, area</td>
</tr>
<tr>
<td>Narrative</td>
<td>Names of objects</td>
</tr>
<tr>
<td>Descriptive</td>
<td>Additional property of feature (e.g. scenic route)</td>
</tr>
<tr>
<td>Warning</td>
<td>Dangerous nature of feature (e.g. sunken wreck)</td>
</tr>
<tr>
<td>Functional</td>
<td>Locatable ground feature (e.g. rescue post)</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Legal information (e.g. area of land)</td>
</tr>
<tr>
<td><strong>Analytical text</strong></td>
<td>Links user with attribute of features</td>
</tr>
<tr>
<td>Confirmative</td>
<td>Spatial relations (e.g. distance between features or bearings)</td>
</tr>
<tr>
<td>Determinative</td>
<td>Tables placed alongside map</td>
</tr>
<tr>
<td>Interpretive</td>
<td>Difficult to get information from a map so provided (e.g. quickest route is...)</td>
</tr>
<tr>
<td>Reference</td>
<td>Text alongside map</td>
</tr>
<tr>
<td>Categorisation</td>
<td>Categorisation of a theme in codes (e.g. geological codes)</td>
</tr>
<tr>
<td><strong>Positional Text</strong></td>
<td>Text to describe or confirm location, in space or time</td>
</tr>
<tr>
<td>Geocoding</td>
<td>Grid reference positions</td>
</tr>
<tr>
<td>Measurement</td>
<td>Relative position (e.g. at edge of map, 20 miles to...)</td>
</tr>
<tr>
<td>Temporal Position</td>
<td>Text to give time of events (e.g. historic battles)</td>
</tr>
<tr>
<td><strong>Metadata</strong></td>
<td>Refer to the nature of source data to map as a whole (e.g. reference ellipsoid)</td>
</tr>
</tbody>
</table>
ASIA

PACIFIC OCEAN   INDIA   CHINA

Kara Sea   Sea of Okhotsk   Rajasthan   Sichuan   Irkutsk   Punjab

Korea Bay   Gulf of Thailand   Ob Bay   Beijing   Tokyo   Mumbai   Karachi

Lake Baikal   Lake Balkhash   North Aral Sea   Morelia   Taraz   Akola   Guillin   Vladivostok   Keelung

Ob   Iset   Aral   Yangze   Ganges   Irmana   Yen

Aksay   Berdsk   Tashk   Strofa   Ustal   Pio
Wes, how have you designed the lettering?
Comic Sans walks into a bar

Barman says

"sorry, we don't serve your type"
Design layout
**Mapped area:** the map itself comprising symbolised points, lines, and areas and typographic components, possibly with the use of imagery.

**Inset/locator map:** showing the larger mapped area in context or detail of a small part of the mapped area.

**Title and subtitle:** the wording that communicates the theme of the map.

**Neatline, frame, or border:** a line that bounds the active map area, frequently constructed from line of an underlying graticule or grid.

**Graticule:** lines of parallels of latitude and meridians of longitude.

**Grid lines:** a reference grid unrelated to latitude or longitude.

**Graticule or grid line labels:** specifying coordinates in degrees or map units.

**Margin:** an area between the active map and the edge of the display, sometimes literally used to contain marginalia on map sheet series.

**Scale:** a statement of the distance range of the map, graphical or a verbal statement, often not required on small-scale thematic maps or where scale differs across the map because of coordinate system or perspective.

**Legend:** list of symbols and their descriptions used to assist map interpretation.

**Orienteation:** a north arrow or other similar symbol to orient the viewer to the map, often unnecessary if a graticule is included or for thematic maps or where the coordinate system means north varies across the map.

**Source:** statement of the origin of data.

**Copyright:** statement of permissions granted or of the copyright holder of the map.

**Map series legend:** used if the map is part of a sheet series.

**Text blocks:** description and/or statements of datums and coordinate systems used or of the date of data and revisions.

**Author details:** a statement on who made the map helps give it authority.

**Features Key**

- **Category:**
  - A: Trees
  - B: Water
  - C: Roads
  - D: Nature

- **Physiographic:**
  - E: High
  - F: Low

**Thematic Legends**

- **Categorical:**
  - A: High
  - B: Medium
  - C: Low

- **Continuous:**
  - A: High
  - B: Medium
  - C: Low

- **Graduated:**
  - A: High
  - B: Medium
  - C: Low

- **Representative:**
  - A: High
  - B: Medium
  - C: Low

**Multivariate Legends**

- **Multi**:
  - A: High
  - B: Medium
  - C: Low

**Multipurpose Legends**

- **A Map About A & B**
  - And, to a lesser extent, C & D

- **A Map About A & B**
  - And, to a lesser extent, C & D
San Diego Walking Map
Wes, how did you design the layout?
Critique (review)
One more thing
Actually...a few more things
The book

In the UC store

esripress.esri.com
The MOOC
esri.com/mooc/cartography (Sep 5th 2018)
The URLs

esri.com/arcgis-blog

carto.maps.arcgis.com

cartonerd.com

adventuresinmapping.com

mapdesign.icaci.org
Other sessions

How to Make a Great Map (Ken Field/Wes Jones)  
Tue 14:30 | Thu 14:30

Amazing and Inspiring maps (Ken Field/John Nelson)  
Wed 10:00 | Thu 10:00

Creating Thematic Maps (Ken Field/John Nelson)  
Wed 08:30 | Thu 13:00

3D Cartographic Techniques (Nathan Shephard/Ken Field)  
Tue 13:00 | Wed 16:00

Map Design for Representing Relief (Ken Field/John Nelson)  
Wed 14:30 | Thu 08:30

ArcGIS Pro: Mapping and Visualisation (Edie Punt/Craig Williams)  
Tue 14:30 | Wed 16:00

Design Story Maps for Emotional Impact (John Nelson/Jennifer Bell)  
Tue 10:00 | Thu 16:00

Choosing the Right Basemap (John Nelson/Andrew Skinner)  
Thu 14:30
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