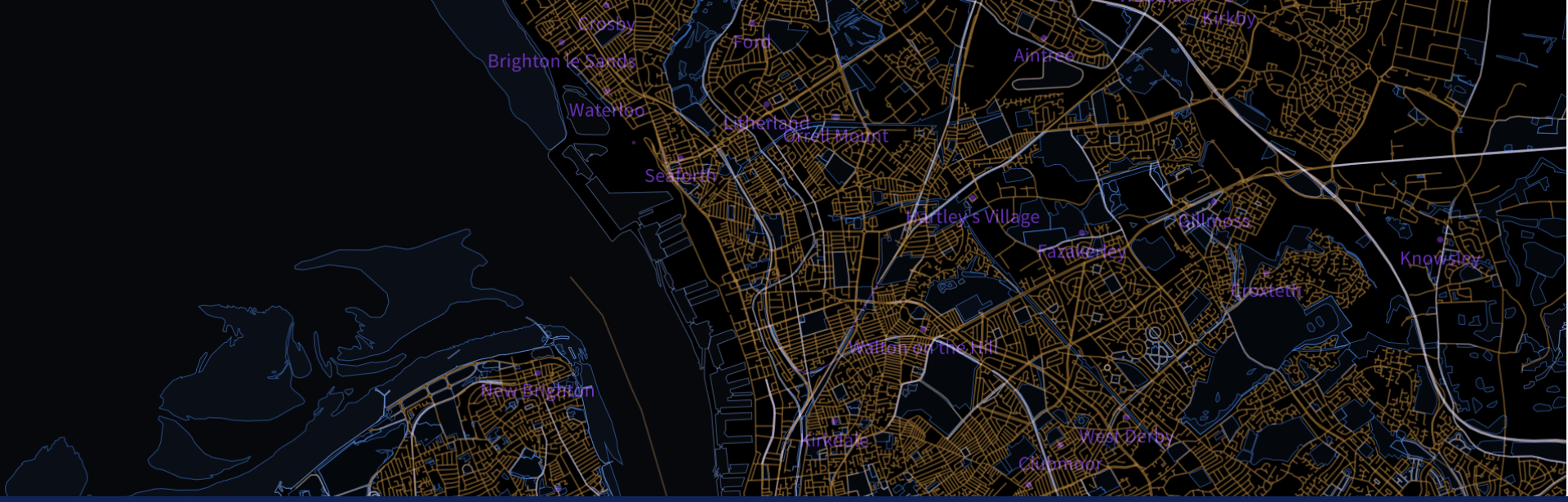

Cartography and Web Mapping

Professor Alex Singleton

Department of Geography and Planning

Dr James Cheshire

University College London,Department of Geography

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www.alex-singleton.com
spatial.ly

Overview and Structure

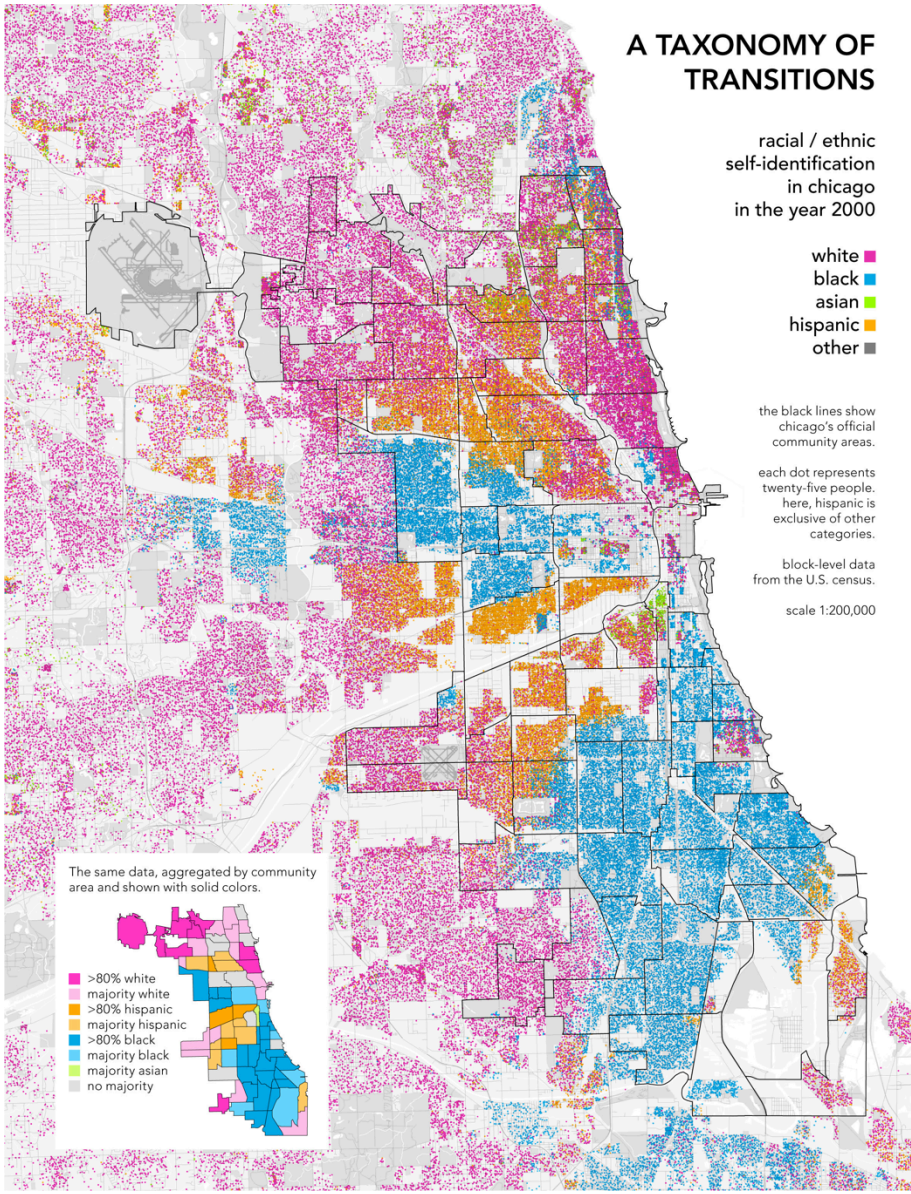
- Purpose of a map
- Different types of maps
- Components of a map

Purpose of a Map

- The combination of good analysis and good visualisation.
- One without the other makes for a outcome.
- Poor analysis with good visualisation is probably more dangerous.
- It is very easy to make a very bad data visualisaton.

Dot Density Maps

- Often dubious.
- People will see each dot as a single instance of a phenomena at a particular location.
- Rely on computational dispersion of dots.
- Originally manually created.
- Unsuitable for sparse populations.



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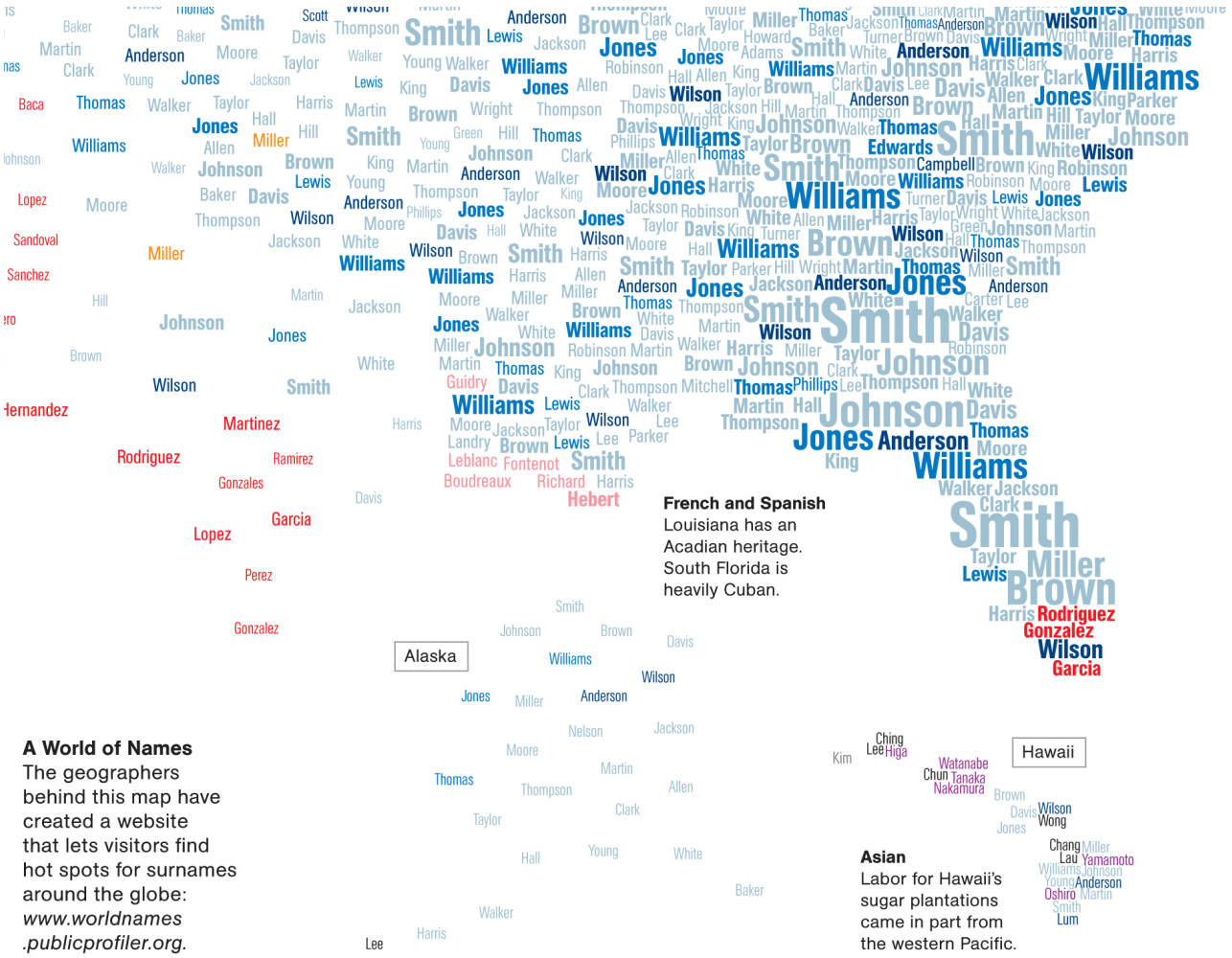
Typographic Maps



French and Spanish
Louisiana has an Acadian heritage. South Florida is heavily Cuban.

A World of Names
The geographers behind this map have created a website that lets visitors find hot spots for surnames around the globe: *www.worldnames .publicprofiler.org.*

Asian
Labor for Hawaii's sugar plantations came in part from the western Pacific.

Top 25 surnames in each state, 2000

- Smith — Less than 10,000
- Smith — 10,000-24,999
- Smith — 25,000-49,999
- Smith — 50,000-74,999
- Smith — 75,000-99,999
- Smith — 100,000-125,000
- Smith — More than 125,000

SMITH IS THE MOST COMMON SURNAME IN THE U.S.

Origin of surname

Europe
- England
- France
- Germany
- Ireland
- Scandinavia
- Scotland
- Spain
- Wales

Asia
- China
- Japan

- Other

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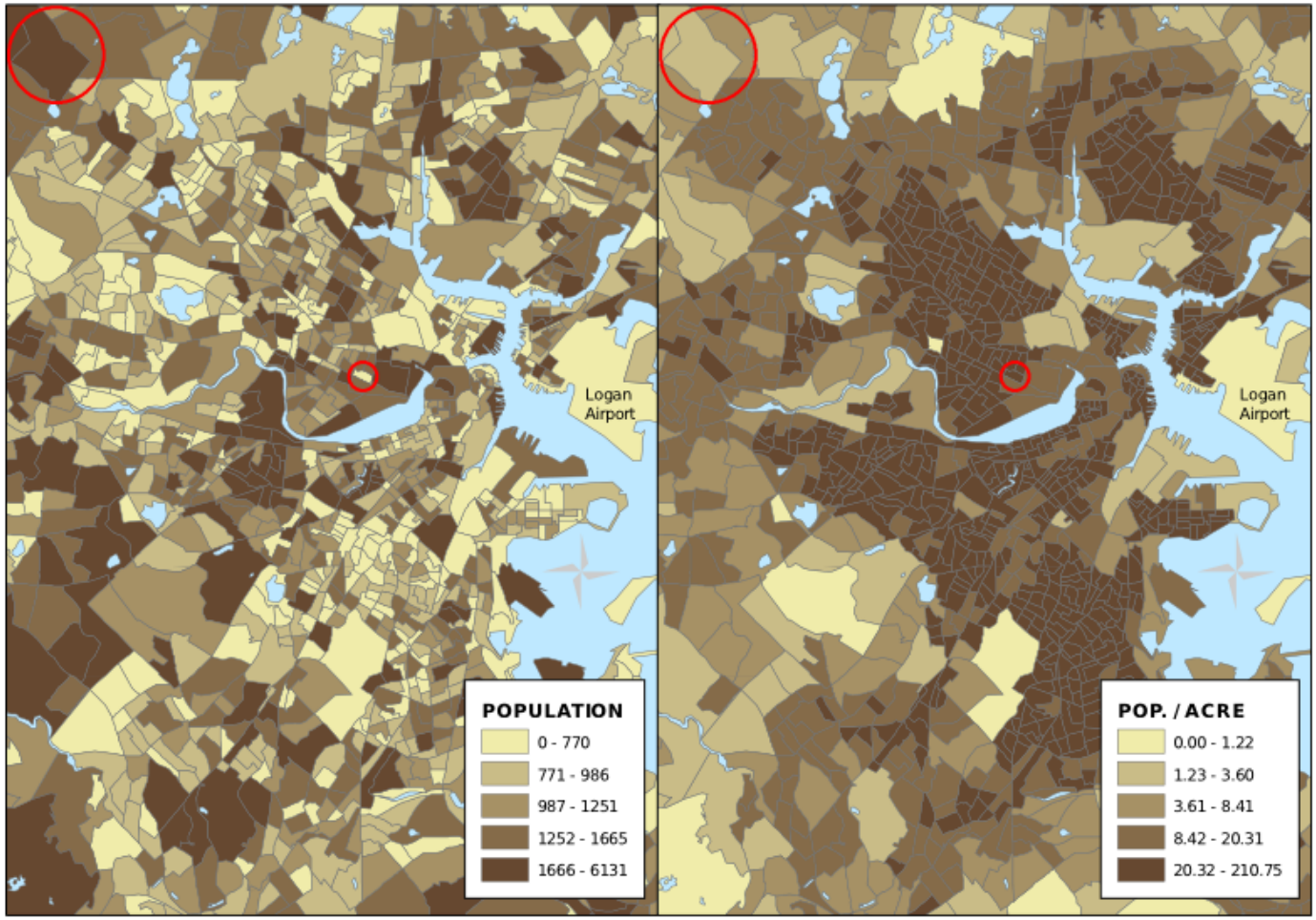
Choropleth Maps

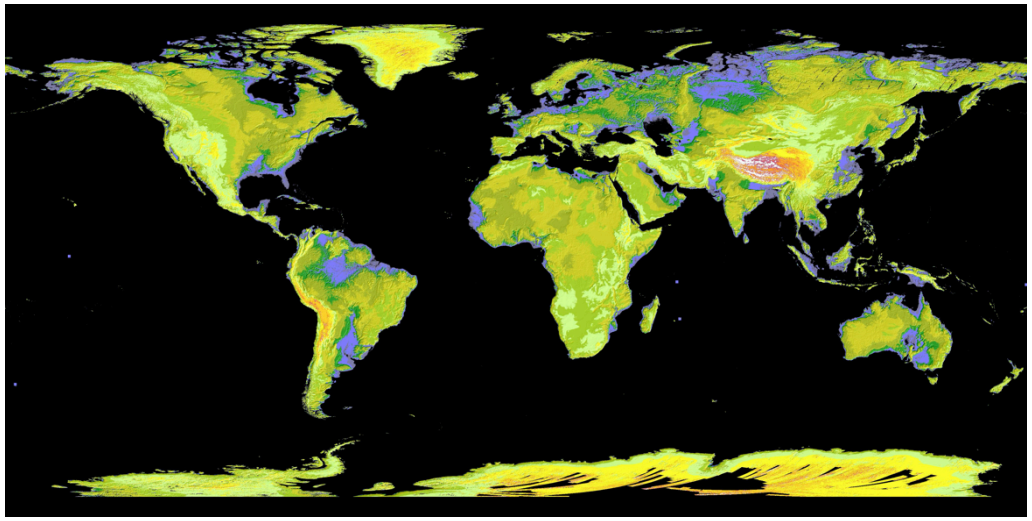
Total Population of 2000 Census Block Groups

Population Density of 2000 Census Block Groups



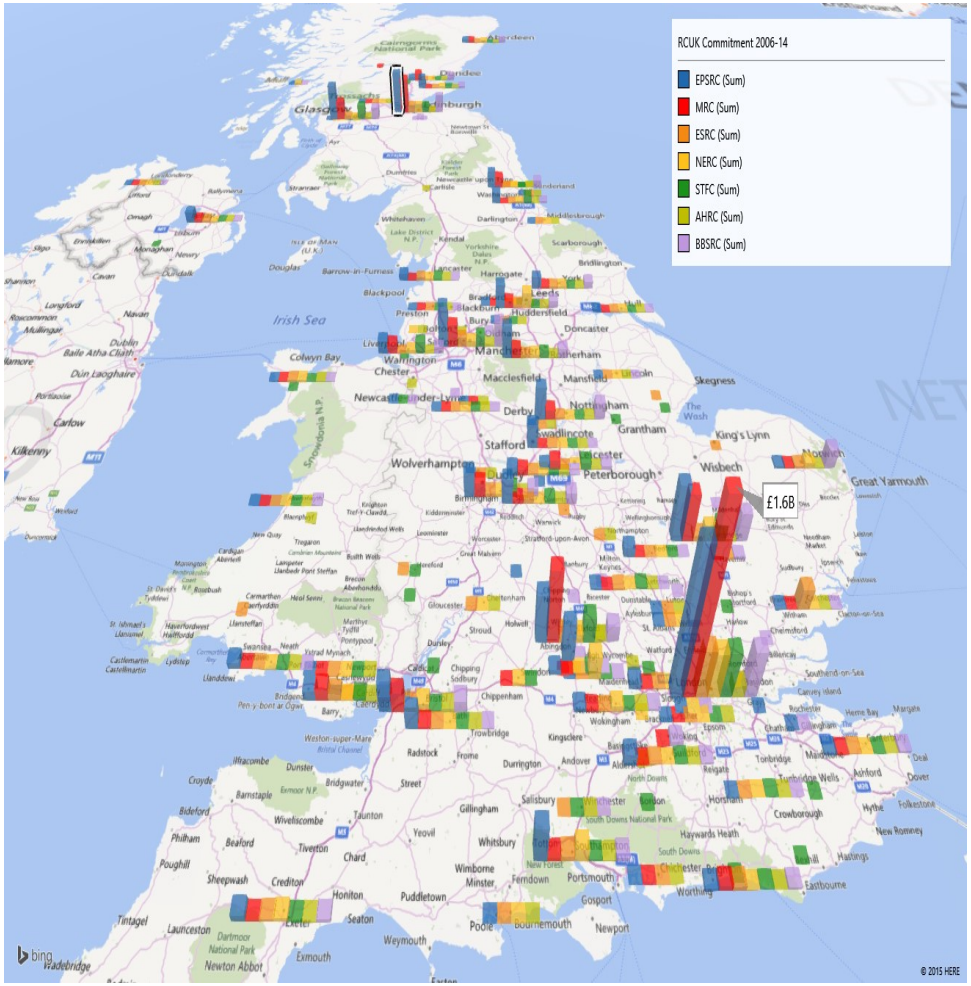
Surfaces

- Good for derived data (densities, rates etc)
- For density and population maps, dark=more
- For topography light = more elevation
- Contours are best avoided unless really necessary.



3D Plots

- Only work if they are interactive.
- Can be good for multivariate data.
- Generally terrible when printed and often unnecessary.



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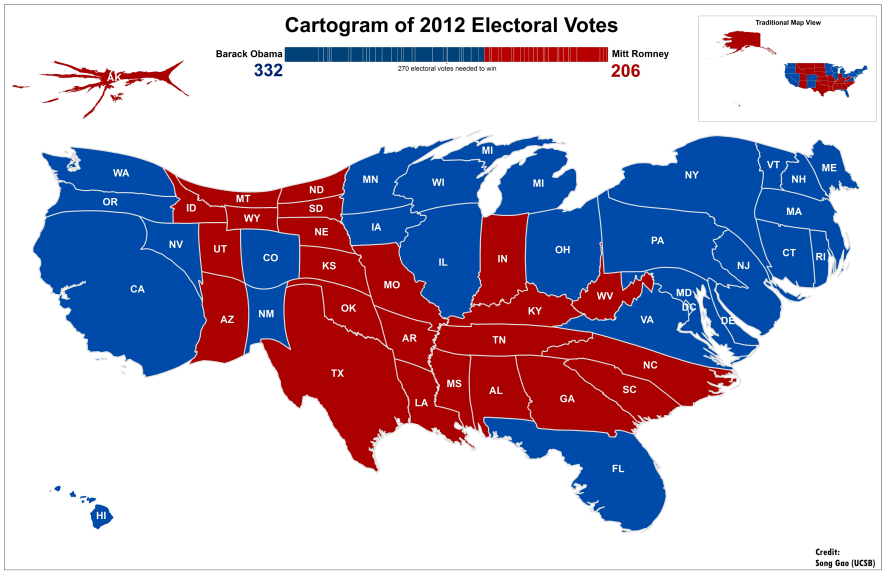
Cartograms

- Good for multivariate data
- Can emphasise areas of the map of interest (often where people live).
- Use one variable for colour, the other for scaling
- Gastner-Newman a popular algorithm
- Can be hard to interpret.



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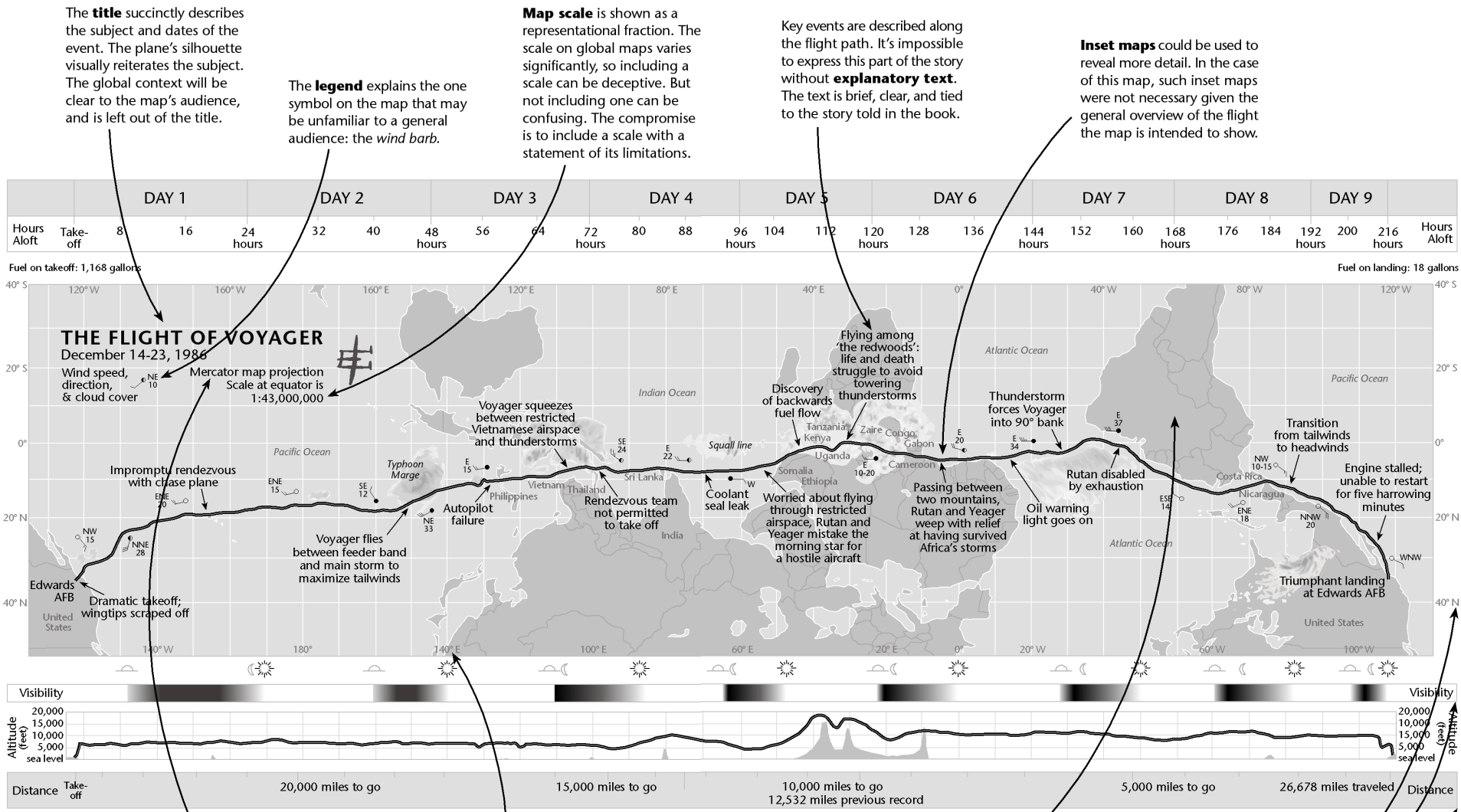
Krygier and Wood's Checklist

- What is the map trying to accomplish?
- Do you really need a map?
- Is the map suited to the audience?
- Have you included sufficient attribution information for data sources etc.?
- What are the likely impressions of the map?
- Are the data appropriate for the map's purpose?
- Does the symbolisation reflect the character of the phenomenon/ data?
- Is the level of generalisation appropriate?
- Implications of the origins of the data?

Krygier and Wood's Checklist

- Data quality/ accuracy.
- Copyright?
- Appropriate projection and CRS?
- Does title indicate what, when where?
- Does textual information add anything?
- Does the legend include symbols that are not self-explanatory?
- North arrow?
- Do variations in design reflect variations in data?
- Context of the map clear?
- Is the typeface appropriate?
- Is colour being used effectively?


The **title** succinctly describes the subject and dates of the event. The plane's silhouette visually reiterates the subject. The global context will be clear to the map's audience, and is left out of the title.
The **legend** explains the one symbol on the map that may be unfamiliar to a general audience: the *wind barb.*
Map scale is shown as a representational fraction. The scale on global maps varies significantly, so including a scale can be deceptive. But not including one can be confusing. The compromise is to include a scale with a statement of its limitations.
Key events are described along the flight path. It's impossible to express this part of the story without **explanatory text**. The text is brief, clear, and tied to the story told in the book.
Inset maps could be used to reveal more detail. In the case of this map, such inset maps were not necessary given the general overview of the flight the map is intended to show.
DAY 1
DAY 2
DAY 3
DAY 4
DAY 5
DAY 6
DAY 7
DAY 8
DAY 9
Hours Aloft
Take-off
Hours Aloft
Fuel on takeoff: 1,168 gallons
Fuel on landing: 18 gallons
THE FLIGHT OF VOYAGER
December 14-23, 1986
Wind speed, direction, & cloud cover
Mercator map projection
Scale at equator is 1:43,000,000
Pacific Ocean
Indian Ocean
Atlantic Ocean
Pacific Ocean
Atlantic Ocean
Typhoon Marge
Squall line
Impromptu rendezvous with chase plane
Edwards AFB
Dramatic takeoff; wingtips scraped off
Voyager flies between feeder band and main storm to maximize tailwinds
Autopilot failure
Voyager squeezes between restricted Vietnamese airspace and thunderstorms
Rendezvous team not permitted to take off
Coolant seal leak
Discovery of backwards fuel flow
Flying among 'the redwoods': life and death struggle to avoid towering thunderstorms
Worried about flying through restricted airspace, Rutan and Yeager mistake the morning star for a hostile aircraft
Passing between two mountains, Rutan and Yeager weep with relief at having survived Africa's storms
Thunderstorm forces Voyager into 90° bank
Oil warning light goes on
Rutan disabled by exhaustion
Transition from tailwinds to headwinds
Engine stalled; unable to restart for five harrowing minutes
Triumphant landing at Edwards AFB
Visibility
Visibility
Altitude (feet)
20,000
15,000
10,000
5,000
sea level
Distance
Take-off
20,000 miles to go
15,000 miles to go
10,000 miles to go
12,532 miles previous record
5,000 miles to go
26,678 miles traveled
Distance
Flight data courtesy of Len Snellman and Larry Burch, Voyager meteorologists
Mapped by David DiBiase and John Krygier, Department of Geography, University of Wisconsin-Madison 1987
Voyager pilots: Dick Rutan and Jeana Yeager
Voyager designer: Burt Rutan
The **map projection** is noted in the legend area. **Sources** and the map's **makers** are along the bottom of the map.
The **coordinate system**, latitude and longitude, is revealed by the grid and text around the edges of the main map. An additional statement about the coordinate system would be superfluous.
The south-up orientation of this map suggests that a **directional indicator** should be included. But the educated audience will figure out the orientation quickly, as distinctive continental shapes are still recognizable.
There is no **border** around the entire map, but the alignment of the main map block and data bars provides coherence. A border would be unnecessarily redundant.
Krygier and Wood 2011

Good Practice

- Text
- Colour
- Lines
- Symbols
- Scale and Orientation

Text

- Title
- Data source
- Attribution
- Copyright
- Labels
- Extra context

Labeling


Reykjavik
Keflavik
Selfoss


Reykjavík
Keflavík
Selfoss


Reykjavík
Keflavík
Selfoss

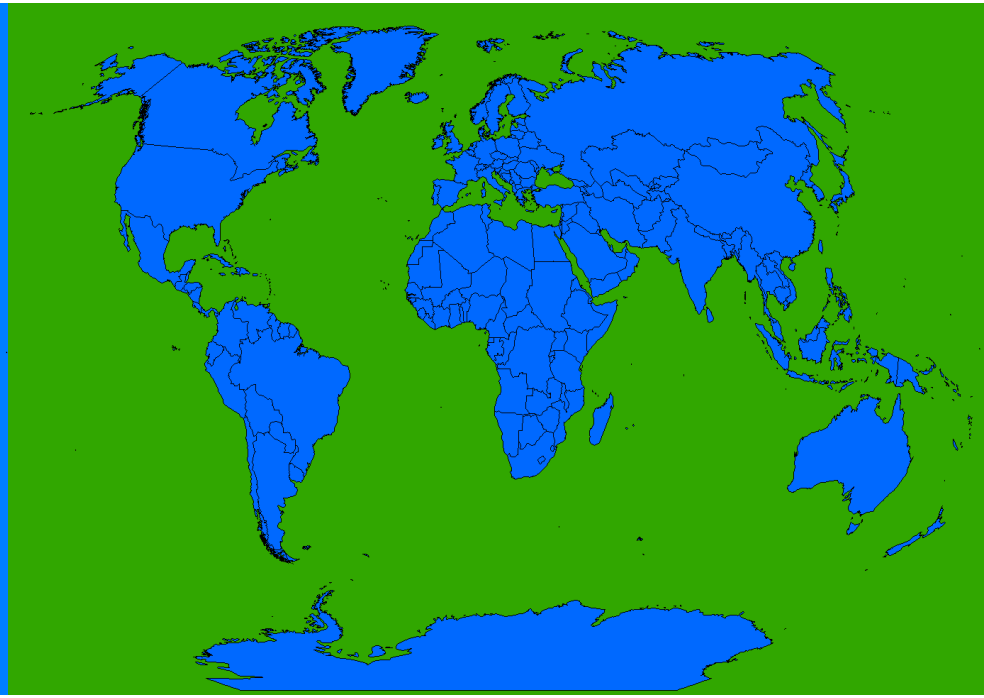

Danube
Borcea


Danube
Borcea

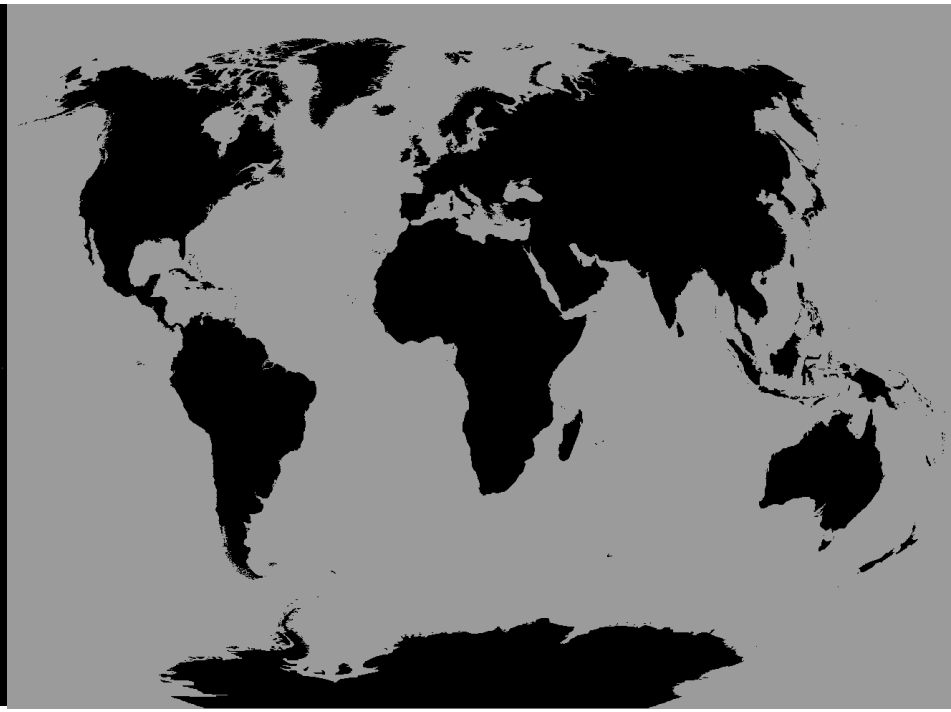
Colour

- Should conform to convention
- Should aid perception
- Should be appropriate to the data:
  - Continuous vs categorical.
  - Correct breaks.
- Can often be avoided

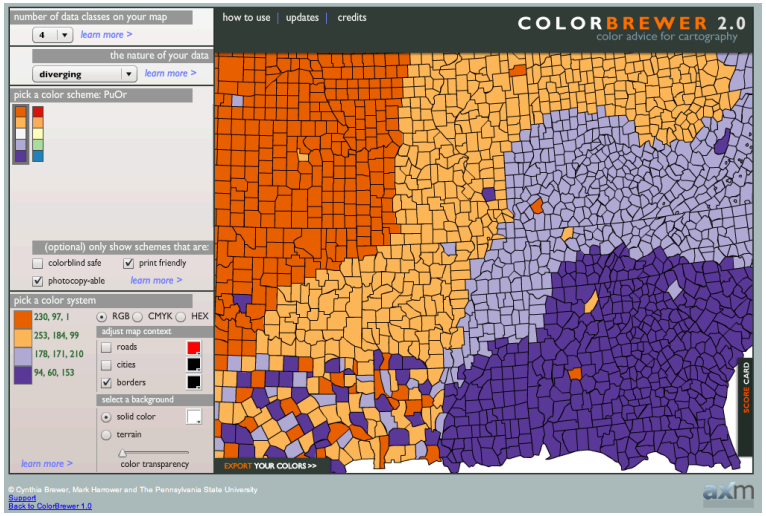
Colour: Convention

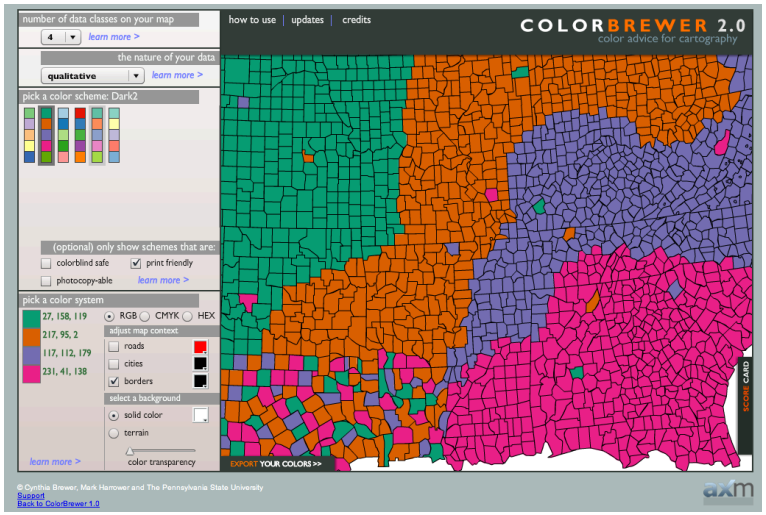


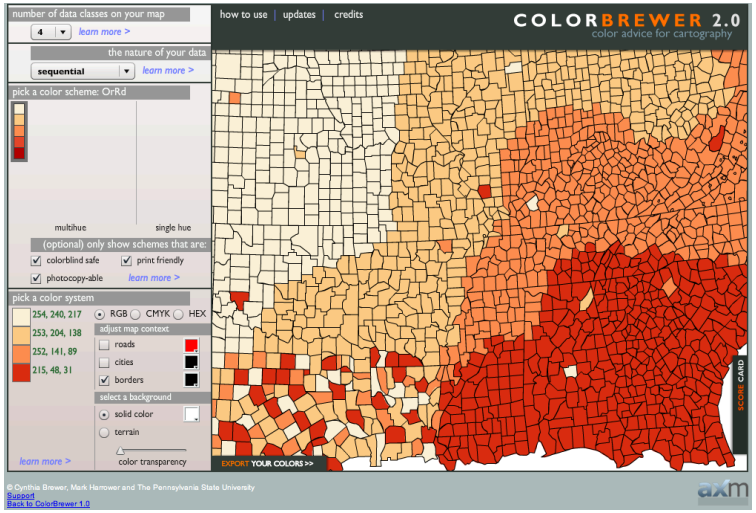
Colour: Convention



Colour: Palletes







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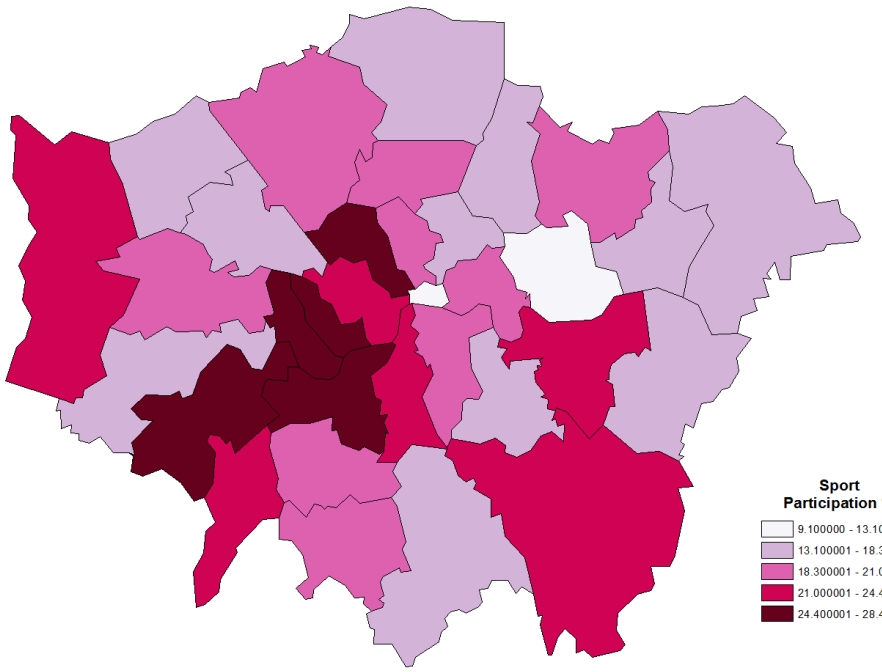
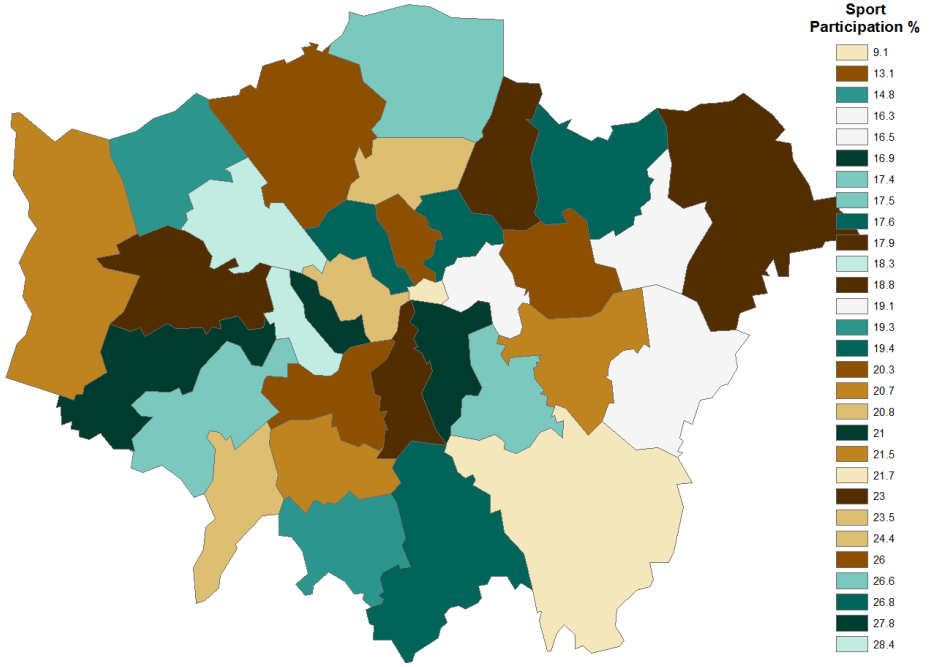
Colour: Continuous vs Categorical data, Quantitative vs Qualitative





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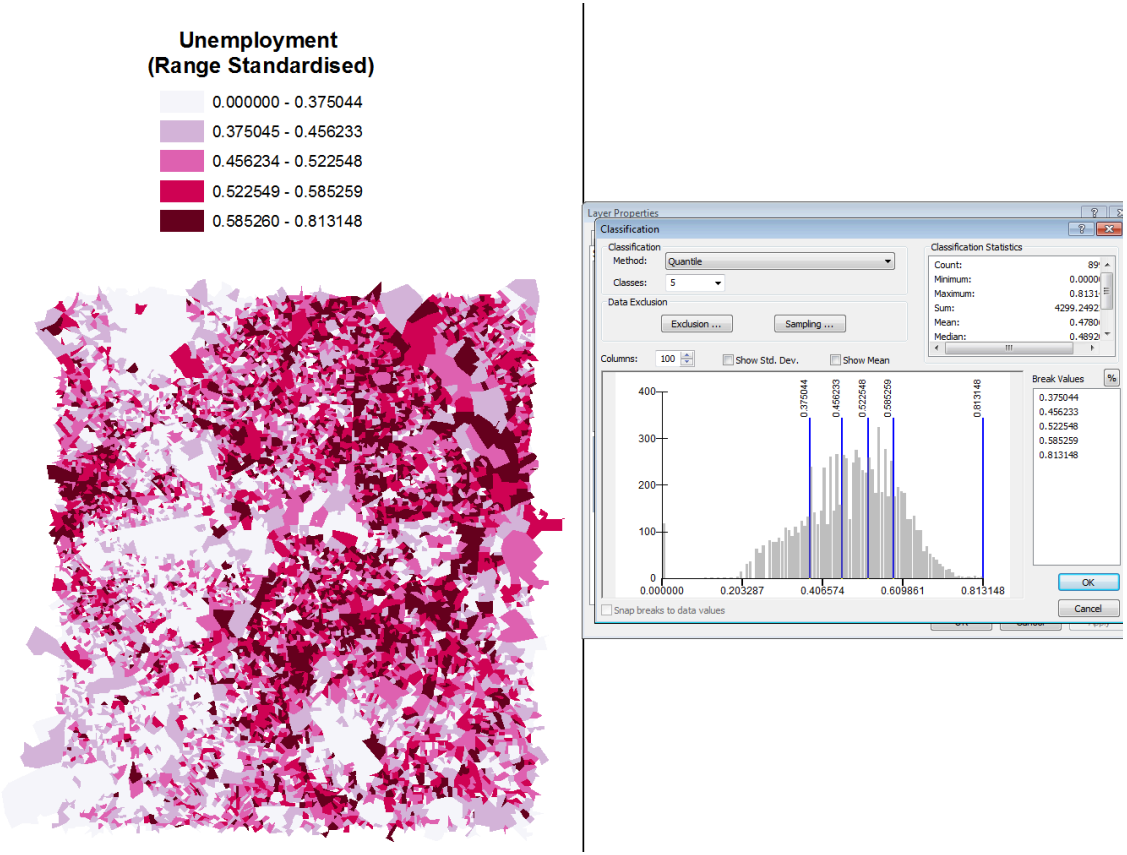
Colour: Classification- Quantile



Same number of data values in each class.
Always produce distinct map patterns.
Often place similar values in different groups and vice versa.

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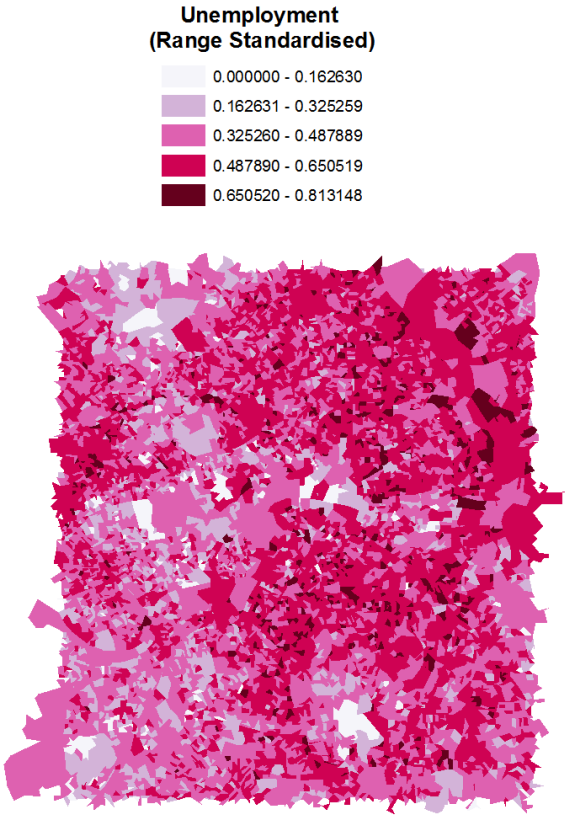
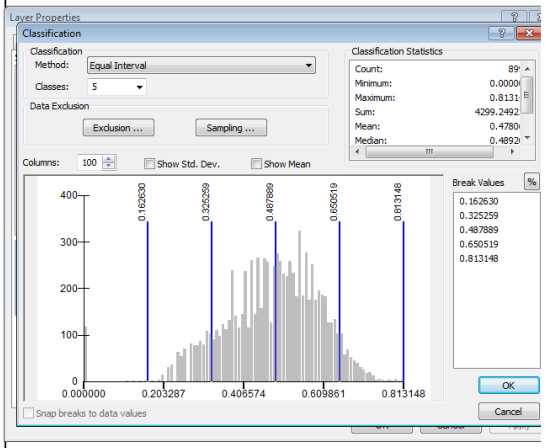
Colour: Classification- Equal Interval





Boundaries between classes at regular intervals.
Easily interpreted and facilitate comparison.
Does not account for data distribution.

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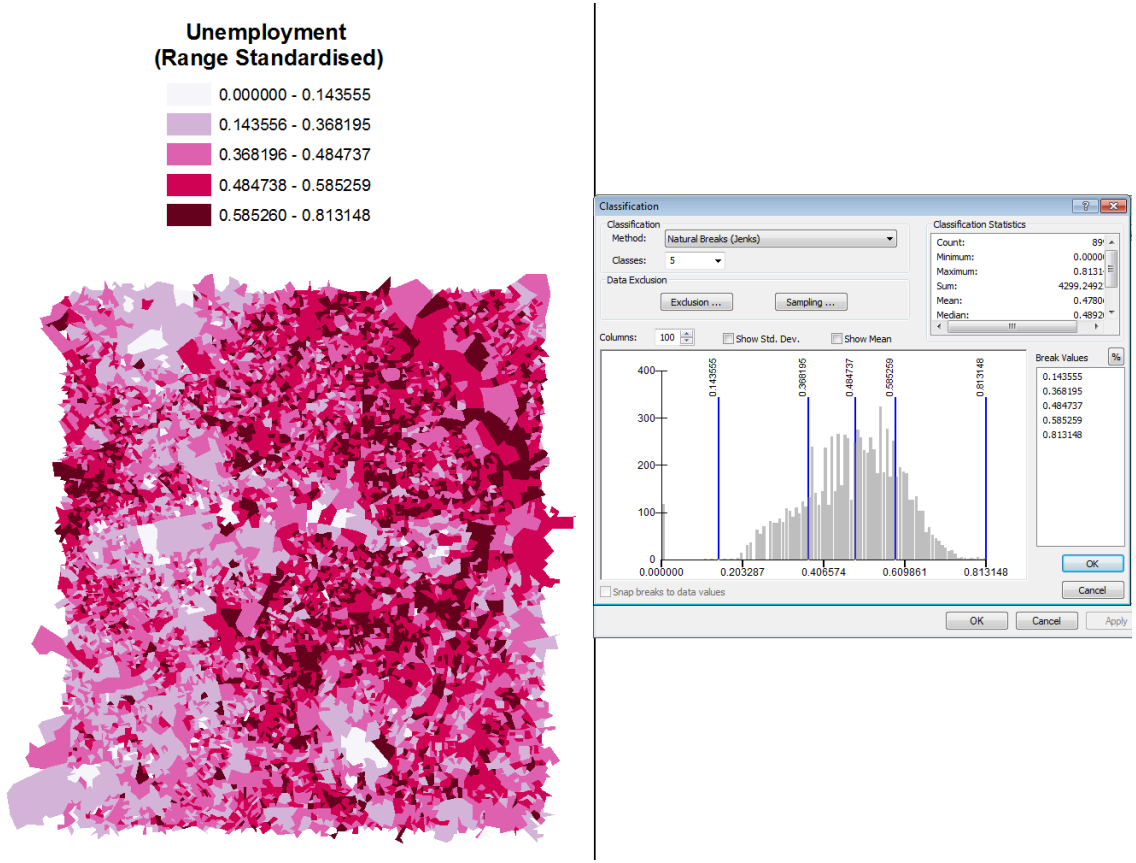
Colour: Classification- Jenks



Minimises within class and maximises between class differences.
Clusters data into similar groups.
Good default scheme.

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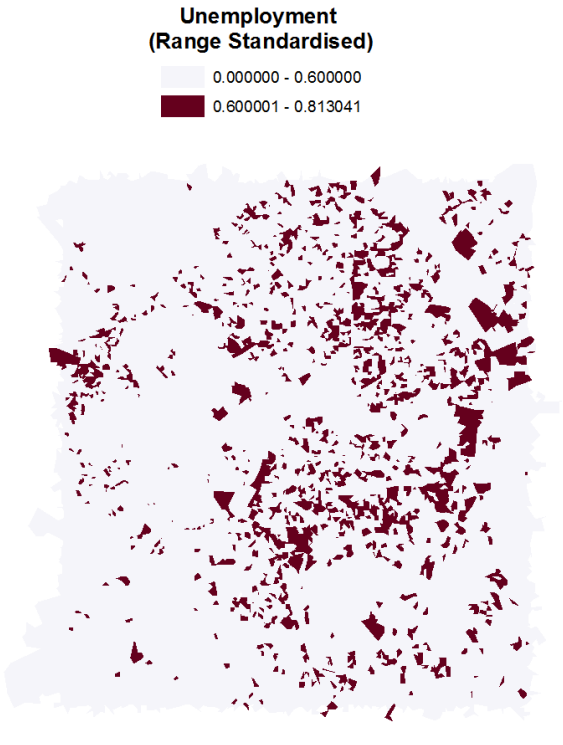
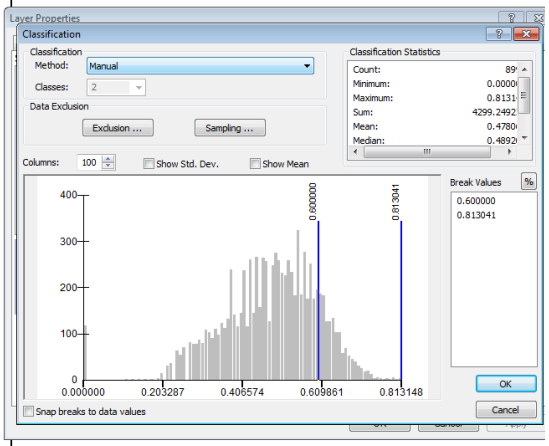
Colour: Unique/ Manual





Good to highlight specific features in the data.
Easy to get wrong.

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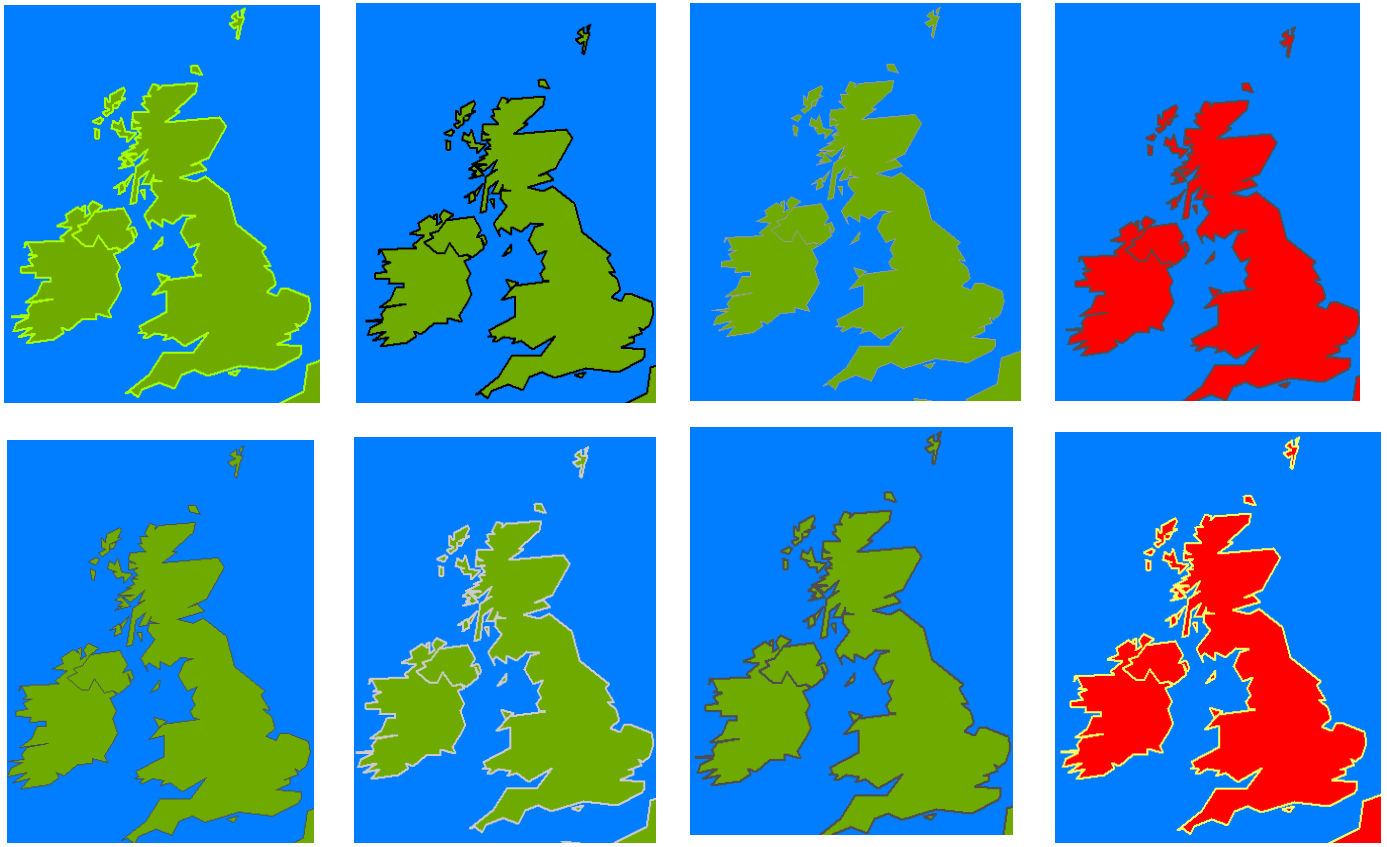
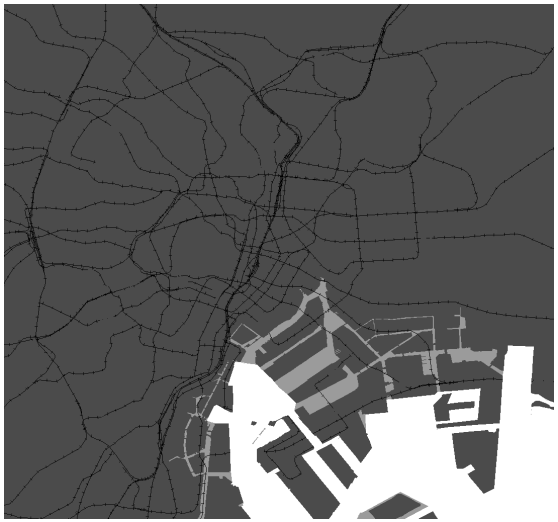
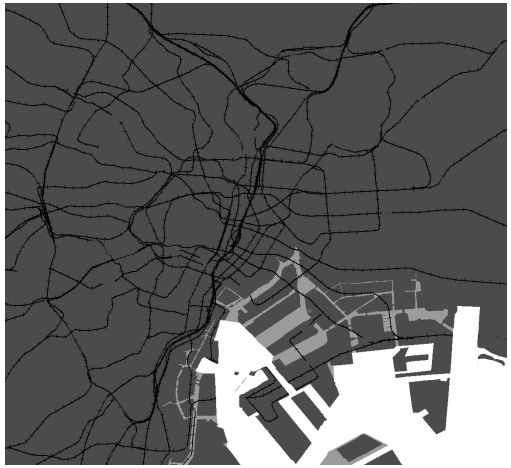
Colour: Can it be avoided?

Lines: Outlines



Lines





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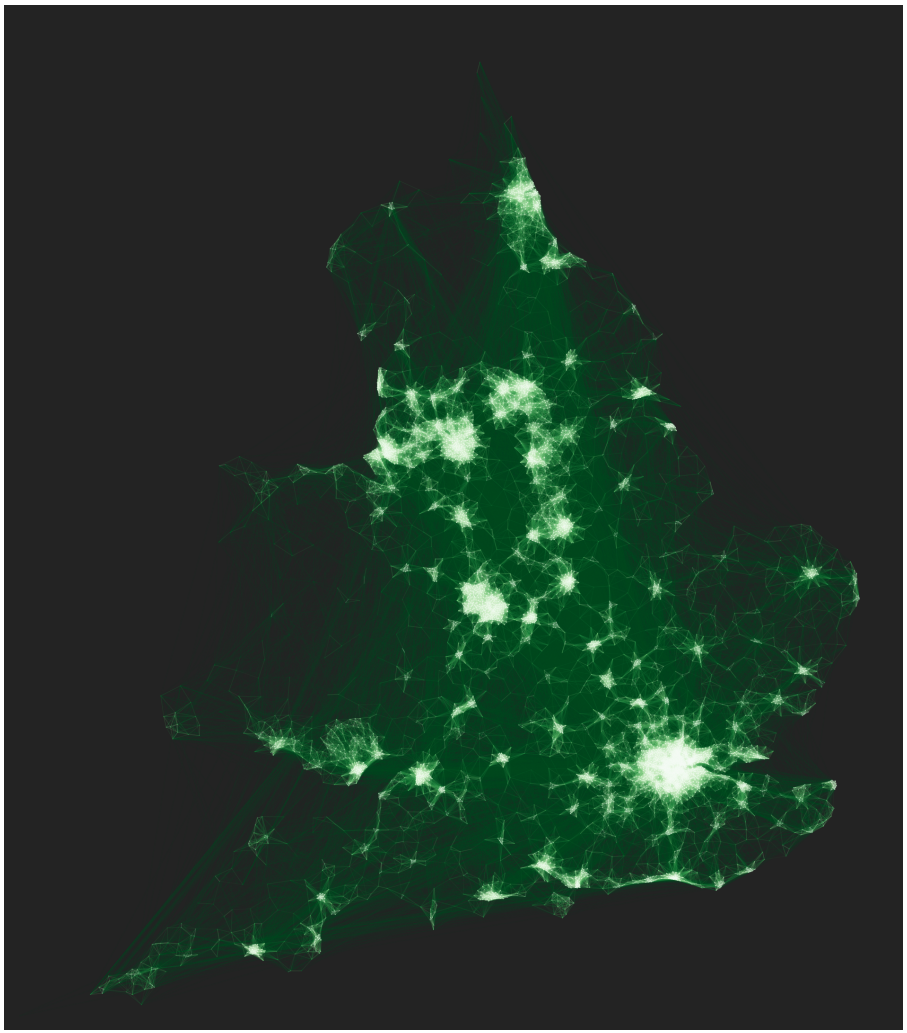
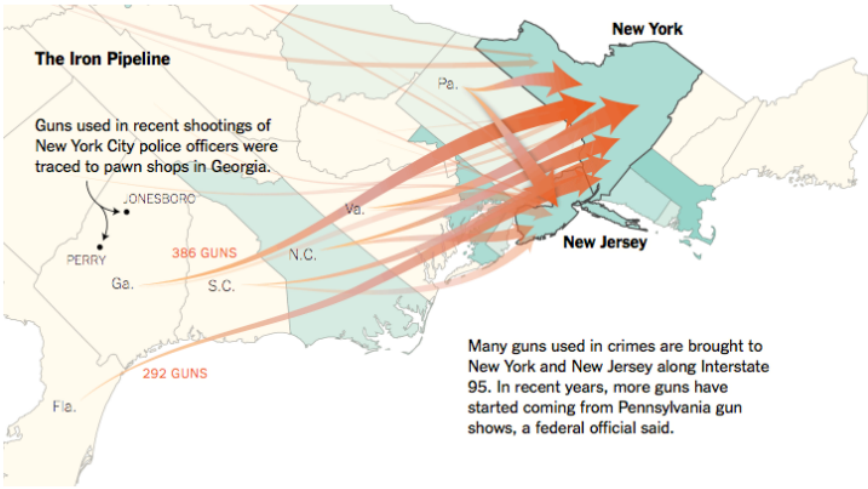
Lines: Flows





http://www.undertheraedar.com/2014/10/flow-mapping-with-qgis.html

Symbols

Ways to Think about Map Symbols

Everything on a map is a symbol. Map symbols, or signs, have two parts. The first is conceptual: an earthquake epicenter, a cold front, a sphere of influence. The second is a graphic mark. The mark is connected to the concept by a code or convention. For example, a cold front is often, though not always, shown as a blue line with regularly spaced triangles pointing in the direction of the front's movement:

Resemblance

Some map symbols look like particular data or concepts. A map showing the location of airports uses an airplane symbol. Airplanes make us think of airports.

Maps in a war atlas use red explosion symbols to show the location of battles. The symbol looks like an explosion, and we think of danger or conflict.

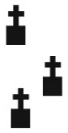
Relationship

Some map symbols intuitively suggest general kinds of data. A map showing the population of different cities uses circle sizes from small to large: sizes vary in amount, as do the data.

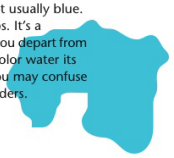
A map showing restaurants, antique stores, and museums in a town uses different shapes; shapes vary in kind, as do the data.

Convention

Of course, all map symbols are symbols by convention. But this is particularly clear when symbols reveal cultural bias or don't resemble what they symbolize. The U.S. Geological Survey uses a Christian cross to symbolize all places of worship – church, mosque, synagogue. Fail!

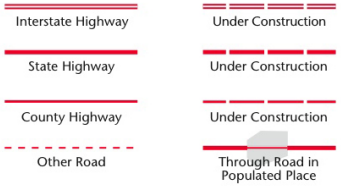


Most maps use blue for water. But water is not usually blue. Except on maps. It's a convention. If you depart from conventions (color water its actual color) you may confuse your map's readers.



Difference

All symbols work by being different from other symbols. But some symbols can be developed from others by using a process of visual differentiation.

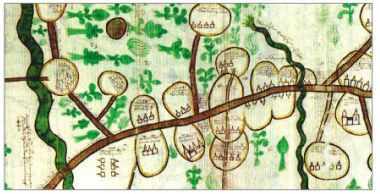


Standardization

Isotype consists of a series of "universally communicable" symbols. Such standards aim to reduce ambiguity through a shared set of common map symbols.

Unconvention

Old maps reveal startling, unconventional map symbols, often conventions of the past. This 17th-century Russian map contains very unconventional symbols for trees, rivers, and properties.



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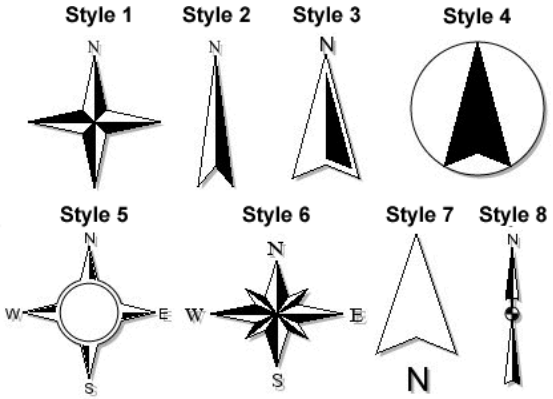
From Krygier and Wood 2011

Map Scale and Orientation

- Numerical: 1:100,000
- Visual: ⊢——⊣ 10km
- Verbal: 1cm= 10km
- Always good to show direction (conventionally North).
- Can be implied by graticule.



Final Tips

- Default colours etc are generally bad.
- It is sometimes acceptable to break the rules.
- How does your visualisation compare to those you admire or have been impressed by?
- The ultimate question to ask is “does it look right?”
- Leave plenty of time.

Many thanks…

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