Johns Hopkins University estimates

200M Black Death (Bubonic Plague) 1347-1351

World's deadliest pandemics



Review of Thematic line techniques: 1. Graduated lines



2. Topological Cartograms

These are based on shape (geometry) and **connectivity** e.g. route networks; distance is relatively unimportant; the classic examples are city underground and train maps,



3.Isolines - lines of equal value * Often created from point data e.g. Isobars - barometric pressure (pictured) thematic scale = line interval



Selected types of isolines – mostly climatic

Isobath	depth below a datum (e.g. mean sea level)
Isogonic line	magnetic declination
Isocline	magnetic dip (inclination) or angle of slope
Isohypse (contour)	elevation above a datum (e.g., mean sea level)
Isodynamic line	value of intensity or a component of the intensity of the magnetic field
Isotherm	temperature (usually average)
Isobar	atmospheric pressure (usually average)
Isohyet	precipitation
Isobront	occurrence of thunderstorms
Isanther	time of flowering of plants
Isopag	duration of ice cover
Isodem	population
Isoamplitude	amplitude of variation (often of annual tempera- ture)
Isoseismal line	number (or intensity) of earthquake tremors
Isochasm	annual frequency of aurorae

Isodynam

Isonoet

equal traffic tension

average degree of intelligence

Canadian wins world Scrabble title: Isogriv CEC.NEWS Posted: Nov 08, 1999 7:50 AM ET Last Updated: Nov 08, 1999 A Montreal (McGill) music professor, Joel Wapnick, has won the World Scrabble Championship

Observers described Wapnick's opening move as "brilliant" ... because he used all seven tiles to form the word "**isogriv**"

= a line of equal declination between magnetic and grid north

More than 100 players from 35 countries took part in the weekend tournament. Wapnick, won \$22,500.





ä.

C. Thematic area maps: 1. Isarithms (here isotherms)

HIGH/LOW TEMPERATURES AND PRECIPITATION



colours selected according to the feature being mapped, e.g. blue & red for temperature, yellow for sunshine. Increased chromas are used for higher values

World Sea Temperatures (from satellite imagery)



°C	0	1	3 5	5 7	9	1	1 13	3 1	5 1	7 1	9 2	1 2	4 2	27	30	3	5	
٩F	32	34	37	7 4	1	45	48	52	55	59	62	66	70	7	5	80	86	95

The map above is updated daily and shows ocean water temperature as recorded, 9th Feb 2021

- > Data are gathered by points and interpolated to make lines/areas
- >This adapts a line technique with ranges filled with colour tints



Average snow depth, Nov 15 ... use of blue to suggest snow!

2. Qualitative (categorical) thematic area maps



The boundaries can be subjective and should not be interpreted as 'hard lines'.

3. Thematic mapping - choropleth = 'magnitude at place' (Greek) One value per 'collection unit' (here each country)



Choropleth maps = 'magnitude at place'



Choropleth maps show data from collection units such as census districts or larger areas. They map intensity, % more than numbers.

General (choropleth) class design goals:

- > maximize difference between classes and minimize contrast within classes
- > minimize or eliminate empty classes and avoid too many values in one class



Schemes include these options: e.g. with 4 classes

>Equal steps 0 -10 -20 -30 -40

Geometric 1 - 3 - 9 - 27 - 81

Quantiles (equal counts)
2 - 4 - 7.5 - 10.4 - 40

>Natural breaks 2 - 4 - 6 - 15 - 40

Sample data values (20)

Design of Choropleth Classes

On Isarithmic maps, the intervals are even (equal-steps);

But for choropleth maps:

the class ranges may be changed to match the data distribution Often 'equal steps' give too many values in one class (see below)

TX 2005 Age Adjusted Death Rate, 4 Ranges



https://www.ehdp.com/vitalnet/breaks-2.htm



Tones or chroma are used to depict values in classes with logical ranges.



Source: ICEM (2003:30)

Figure 4.3: Population Density and Protected Area of the LMS in 2003

How not to do classes (using GIS software)





4. Dasymetric = 'measure of density'

Dasymetric maps depict intensities e.g. %, ratios, densities.

They involve analysis beyond admin. districts; i.e. they do not assume homogeneity within districts.

The lines enclosing areas are known as 'Isopleths'

Prince George Citizen

Density map showing auto thefts in Prince George Jan. 1, 2005 to Sept. 30, 2006 HERITAR BE Theft Of Auto Per Square Km Ordinal High Docisity Low Density **Obstickes** 10.00

data

PG week review

5. Topograms - e.g. height applied to chropleth mapping

- Avoids the need to create classes, using (continuous) height

Topogram technique applied to isarithmic data

6. Value-by-area cartograms

a cartogram has no 'cartesian' scale,but area is based on **another geographic variable** More examples: <u>http://www.worldmapper.org</u>

Design principles:

- > Area scale accurately represents a selected variable
- Contiguity is maintained
- > Shapes should remain recognisable (if possible)

2016

Question asked: "Should the UK remain a member of the European Union or leave the European Union?"

a and vote share

(based on 'perceived' space)

A tool of psychological research: People behave according to how they see their 'map'

People tend to: exaggerate the size and importance of their home area recall unusual features, - e.g. the Florida peninsula, 'boot' of Italy, shape of Hudson Bay, etc..

Mental map of Canada

(based on 'perceived space')

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Thematic techniques and data types

Raw values / totals >Dot maps >Proportional symbols >Graduated lines

>Cartograms (value by area)

Derived densities / % values

>Choropleth

>Isometric (topograms)

>Isarithms (mostly)

Local Adaptation Local Adaptation of the state of the sta

1. Choropleth Maps

These are probably the most common kind of thematic map in news publications because their meaning is usually obvious to the reader. They are created by using different shades of color to represent the proportions of a certain magnitude in different areas. They are appropriate for showing ratios, percentages and other *derived* data, and usually don't work very well for displaying *rare* amounts.

In other words: a choropleth map is good for representing the percentage of Hispanic population or the number of abortions per thousand pregnancies, but not for the total number of Hispanics or the total number of abortions in certain areas. The reason is that color intensities are unconsciously associated with concentration of a variable in a certain area, and not with total amounts or values.

2. Dot Maps

These are used to map *discrete* phenomena (see next page), and their main goal is to reveal the density pattern of those phenomena. Every dot or point on the map can represent a single unit or, in the case of small-scale maps that show entire countries or continents, groups of units.

3. Proportional Symbol Maps

If choropleth maps are suited to showing derived (or "standardized") data such as percentages or ratios, proportional symbol maps usually work better with the raw data itself. They are also called "graduated quantitative point symbol" maps because they use objects scaled up or down depending on the amount of a variable in each place. The most widely used symbol is the circle, although is not uncommon to see square-based maps or even triangle-based maps.

4. Isopleth Maps

These share one characteristic with choropleth maps: they also use shades of color (or color lines) to show the density of phenomena in a certain area. However, the boundaries of each shaded area are not determined by political or geographical boundaries, but by "lines of equal value" (called "isolines"). A good example is the very common weather map with the lines that show areas that will have the same temperature the next day.

5. Flow Maps

These represent movement across the map using lines with thicknesses proportional to the values used. The most famous example of this kind of map is Charles Joseph Minard's map of the Napoleon's Russian campaign, discussed in the history of maps chapter. They are very difficult to design, as no software tool will generate one automatically: they have to be drawn manually and every thickness has to be calculated individually, which is both complicated and time consuming. However, when they are well done, they are usually strong, informative and attractive pieces.

6. Cartograms or Value-by-Area

Some designers argue that cartograms cannot be even considered "maps" at all, but pure diagrams. They are called "value-by-area" maps because each area of the map is scaled up or down depending on the density or the value of the phenomena shown.

The main challenge when you're designing these displays is to keep the shapes of the different areas recognizable, as they are heavily distorted in most cases. As in the case of Flow Maps, no GIS software will make the work for you. If you want to create a cartogram, you will have to do it manually.

'Wordclouds'

https://www.wordclouds.com/

