Examples of Geovisualizations (beyond standard maps)

By NTUA

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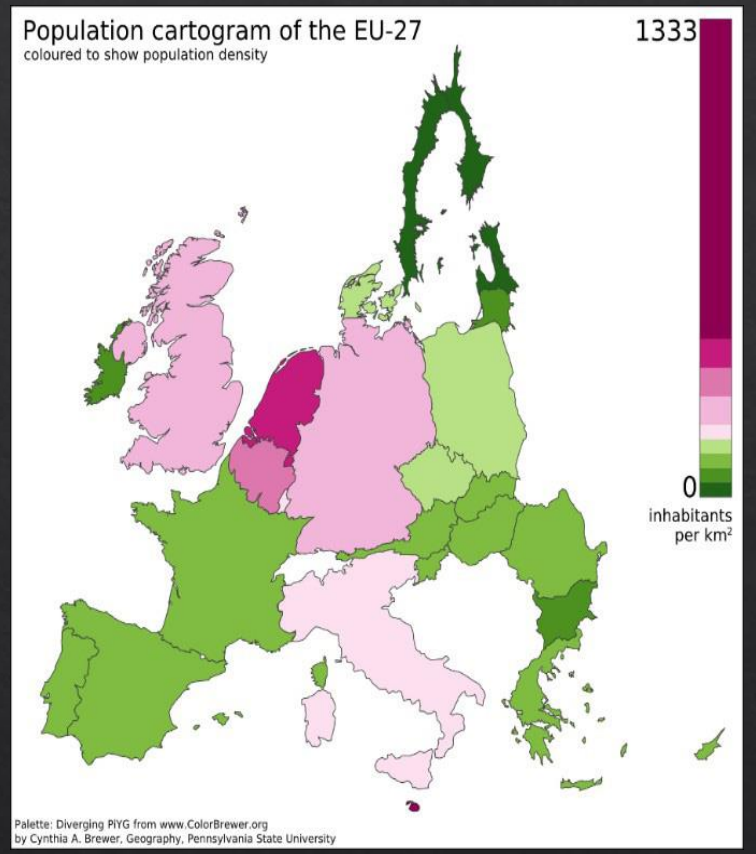
Cartogram

Special case of two-dimensional visualization in which, some thematic variable e.g., time or population is replaced by area or distance. In this way, the display surface is distorted to highlight the subject variable in question.

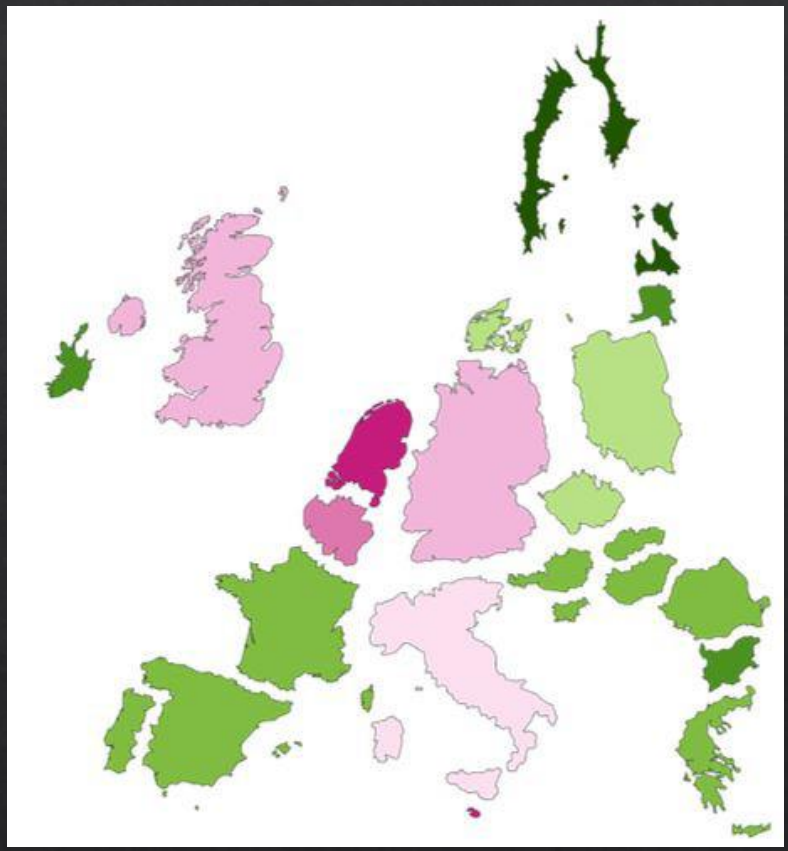
Two types; area and distance.

Area Cartogram - I

Population density cartogram of the EU-27 with and without contiguity



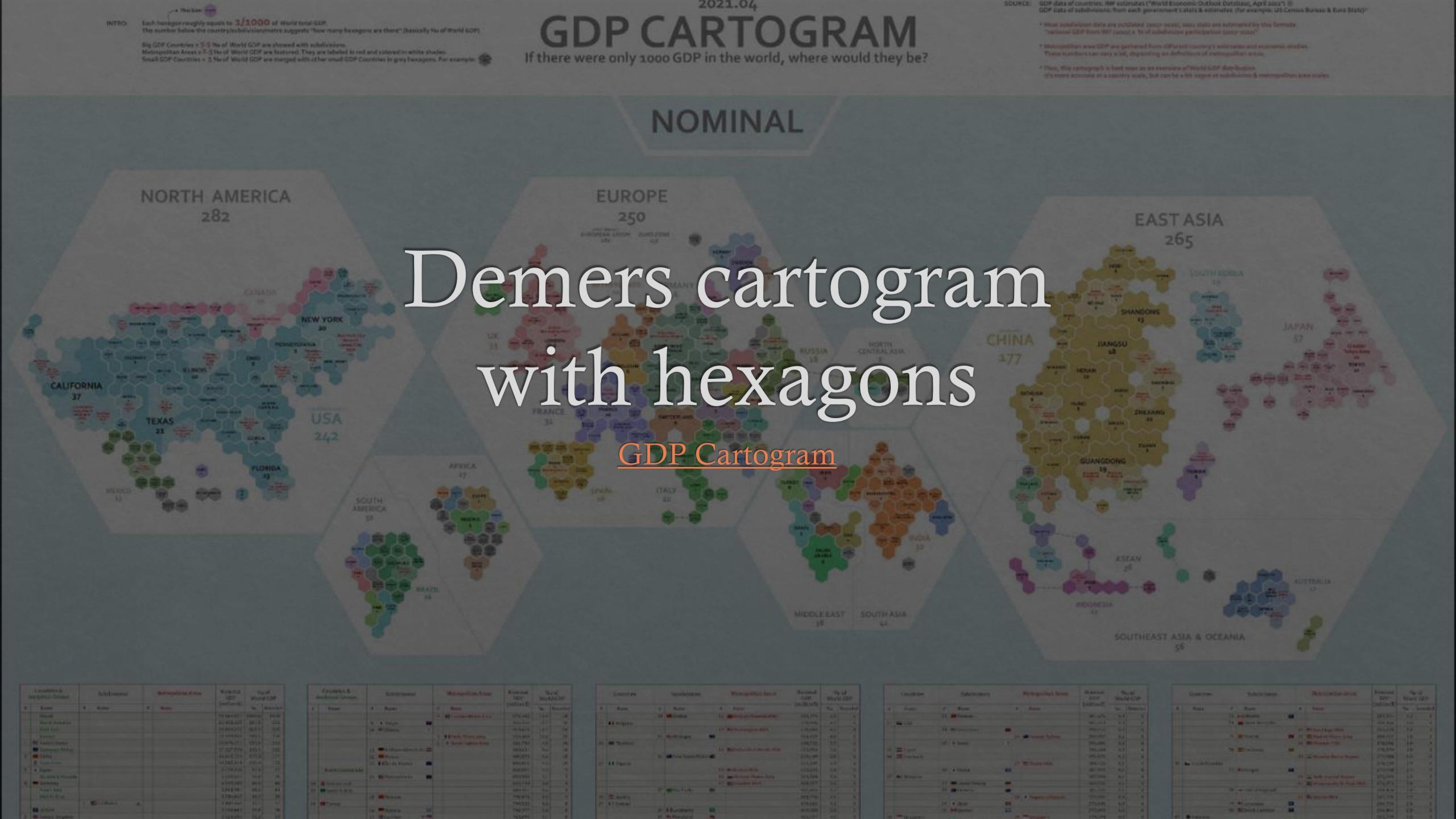
https://upload.wikimedia.org/wikipedia/commons/9/9d/EU_Pop2008_1024.PNG



https://commons.wikimedia.org/wiki/File:EU_Pop2008_1024-not_contiguity.svg

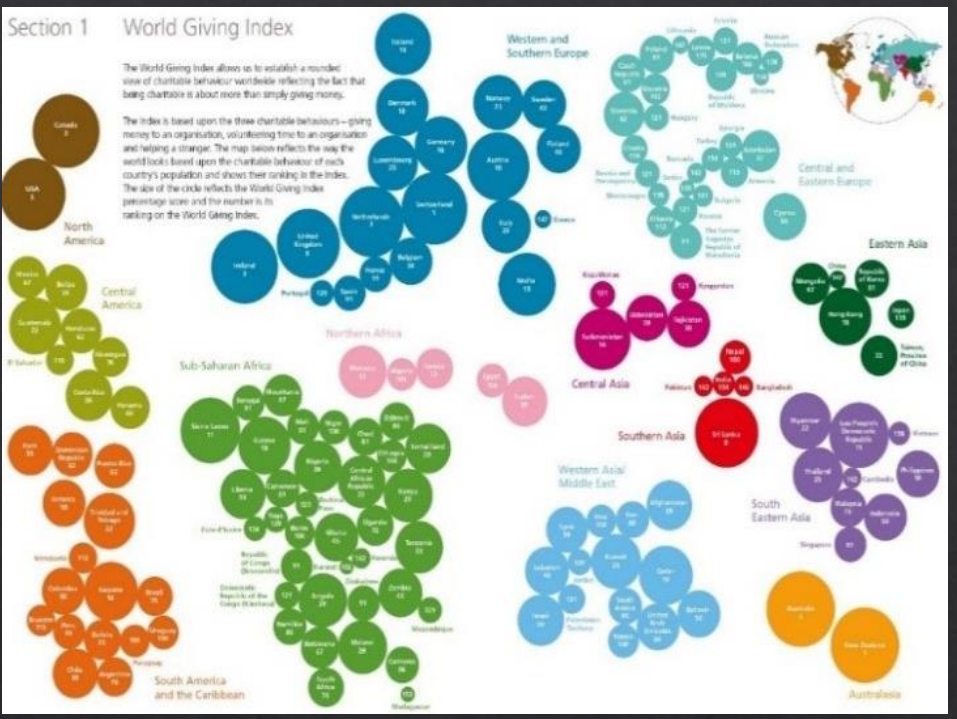
Area Cartogram - II

- Replacement of the polygons (areas/surfaces) of the original map with basic shapes.
  - When the shapes are circles then the cartogram is called a Dorling cartogram in the literature.
  - The Demers cartogram uses squares and hexagons of fixed size, rather than circles, of variable size.

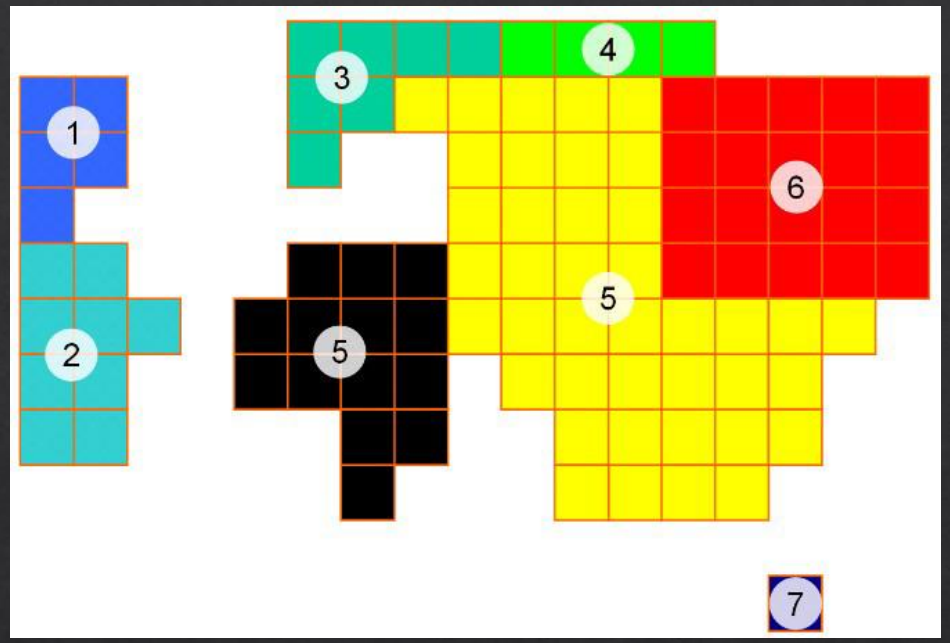


Demers cartogram with hexagons

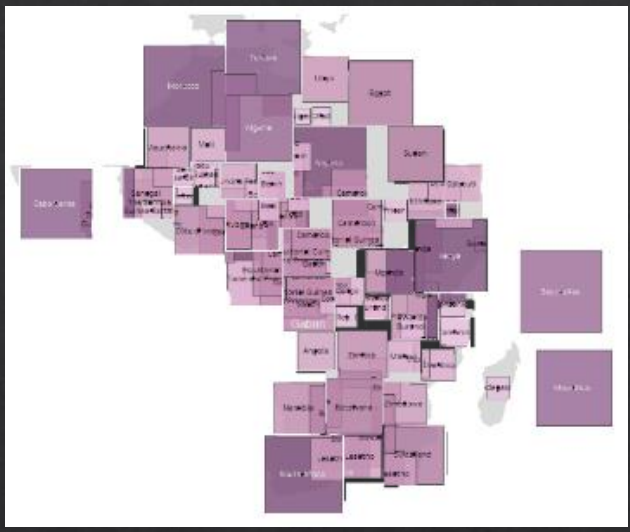
GDP Cartogram



https://www.cafonline.org/docs/default-source/about-us-publications/worldgivingindex28092010print.pdf



https://upload.wikimedia.org/wikipedia/commons/8/82/Isodemographische_Karte_Weltbevoelkerung.png

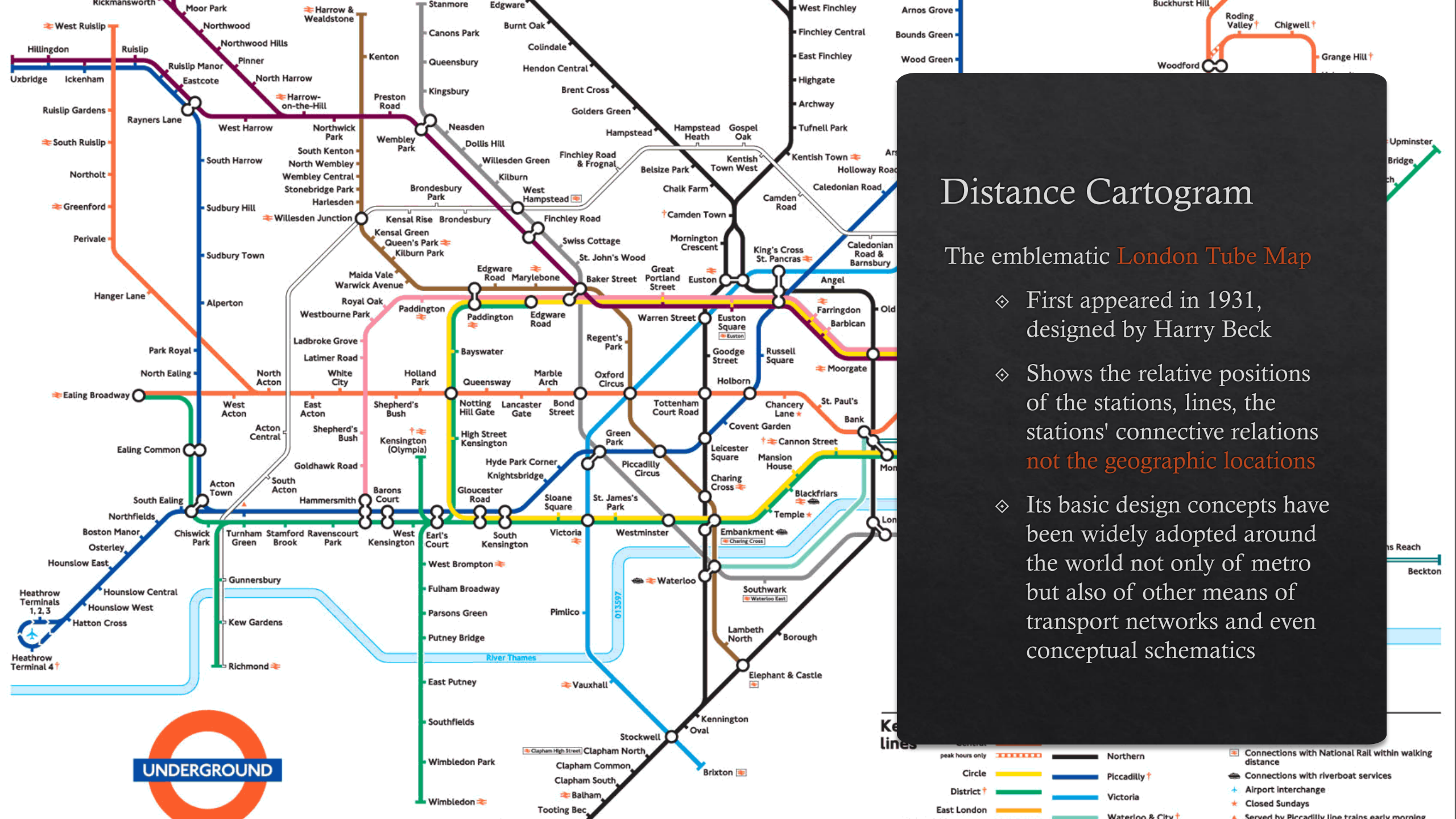


https://www.kenflerlage.com/2017/06/demers-cartograms-and-other-maps-of.html

Dorling Cartogram with variable circle sizes (left), Demers cartogram with fixed (middle) and variable square sizes (right)

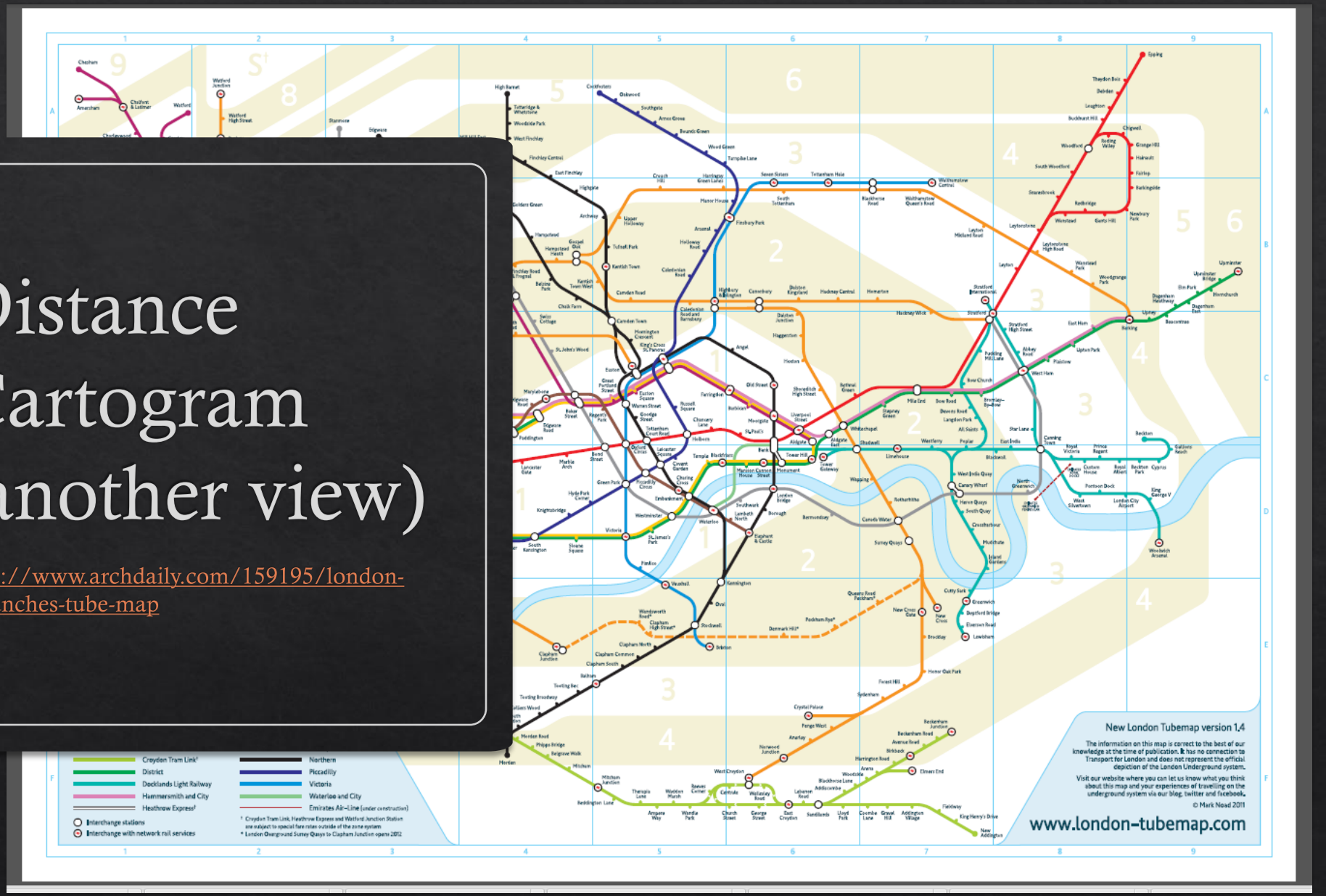
Distance Cartogram

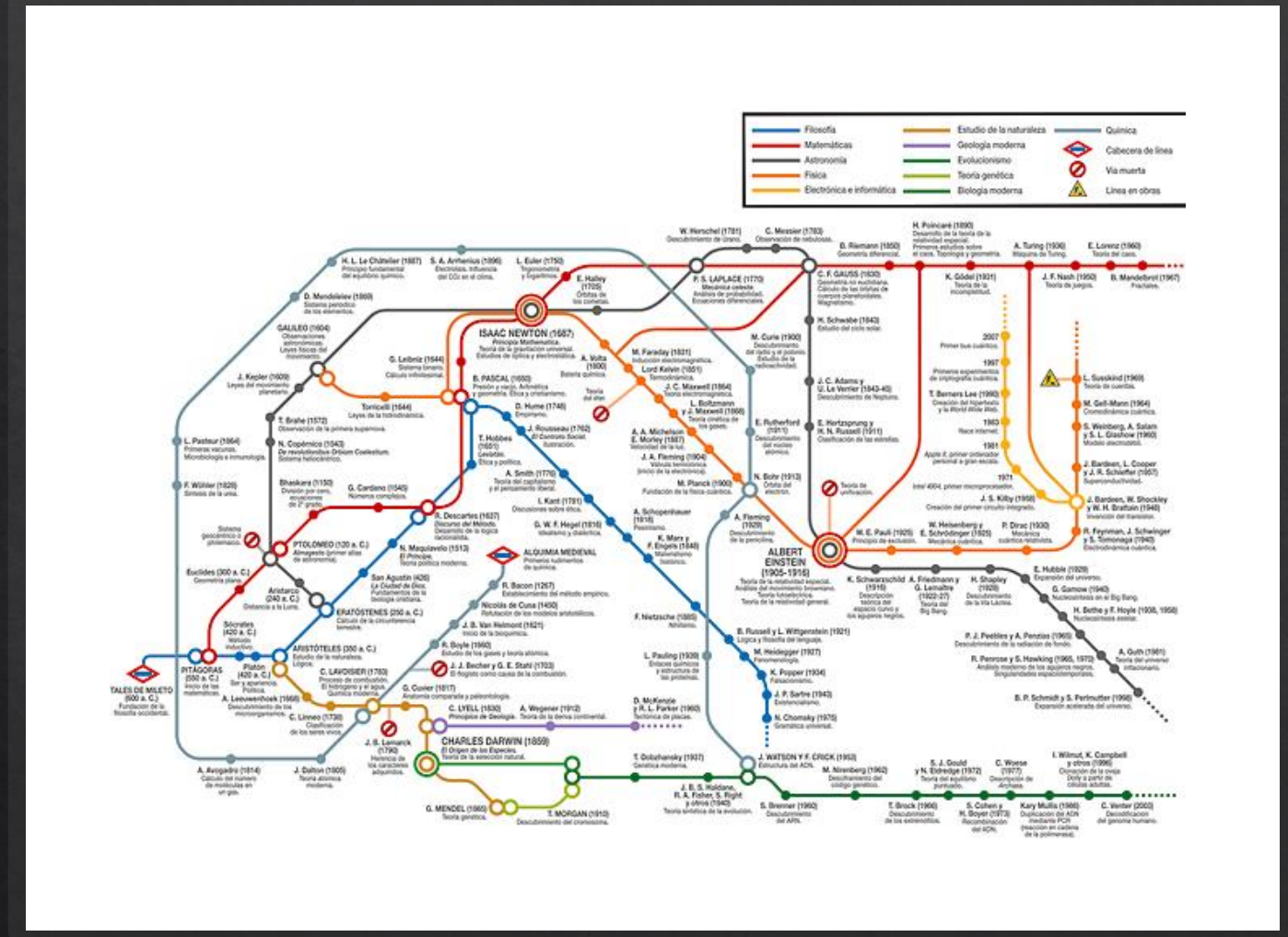
- Also referred to as a topological map because it depicts only a part of the properties of the data (e.g. the adjacency or connectivity relationships between the depicted data) omitting or deliberately distorting the representation of the remaining characteristics.
- The distance cartogram, due to the understandable way of visualizing the information, has also been used as a means of visualizing non-geographical information as a cartographic metaphor (map metaphor).


Distance Cartogram
The emblematic London Tube Map
First appeared in 1931, designed by Harry Beck
Shows the relative positions of the stations, lines, the stations' connective relations not the geographic locations
Its basic design concepts have been widely adopted around the world not only of metro but also of other means of transport networks and even conceptual schematics
UNDERGROUND
Rickmansworth
Moor Park
Northwood
Northwood Hills
Pinner
North Harrow
Harrow & Wealdstone
Harrow-on-the-Hill
West Ruislip
Hillingdon
Uxbridge
Ickenham
Ruislip
Ruislip Manor
Eastcote
Ruislip Gardens
Rayners Lane
West Harrow
Kenton
Preston Road
Northwick Park
South Ruislip
Northolt
Greenford
Perivale
South Harrow
Sudbury Hill
Sudbury Town
Alperton
Hanger Lane
Park Royal
North Ealing
Ealing Broadway
Ealing Common
Acton Town
South Ealing
Northfields
Boston Manor
Osterley
Hounslow East
Heathrow Terminals 1, 2, 3
Hounslow Central
Hounslow West
Hatton Cross
Heathrow Terminal 4
Stanmore
Canons Park
Queensbury
Kingsbury
Wembley Park
Neasden
Dollis Hill
South Kenton
North Wembley
Wembley Central
Stonebridge Park
Harlesden
Willesden Junction
Willesden Green
Kilburn
West Hampstead
Brondesbury Park
Kensal Rise
Brondesbury
Kensal Green
Queen's Park
Kilburn Park
Maida Vale
Warwick Avenue
Edgware
Burnt Oak
Colindale
Hendon Central
Brent Cross
Golders Green
Hampstead
Finchley Road & Frognal
Finchley Road
Swiss Cottage
St. John's Wood
Baker Street
Edgware Road
Marylebone
Paddington
Royal Oak
Westbourne Park
Ladbroke Grove
Latimer Road
White City
North Acton
West Acton
East Acton
Acton Central
Shepherd's Bush
Holland Park
Queensway
Bayswater
Notting Hill Gate
Lancaster Gate
Marble Arch
Bond Street
Oxford Circus
Regent's Park
Warren Street
Euston
Great Portland Street
Euston Square
Goodge Street
Mornington Crescent
Camden Town
Chalk Farm
Belsize Park
Hampstead Heath
Gospel Oak
Kentish Town West
Kentish Town
Camden Road
Caledonian Road
Caledonian Road & Barnsbury
King's Cross St. Pancras
Angel
Farringdon
Barbican
Moorgate
Old
Russell Square
Holborn
Tottenham Court Road
Chancery Lane
St. Paul's
Bank
Covent Garden
Leicester Square
Piccadilly Circus
Green Park
Hyde Park Corner
Knightsbridge
Charing Cross
Embankment
Temple
Blackfriars
Mansion House
Cannon Street
Mon
Lon
Westminster
Victoria
St. James's Park
Sloane Square
South Kensington
Gloucester Road
Earl's Court
West Kensington
Barons Court
Hammersmith
Goldhawk Road
South Acton
Kensington (Olympia)
Chiswick Park
Turnham Green
Stamford Brook
Ravenscourt Park
Gunnersbury
Kew Gardens
Richmond
River Thames
West Brompton
Fulham Broadway
Parsons Green
Putney Bridge
East Putney
Southfields
Wimbledon Park
Wimbledon
Pimlico
Vauxhall
Waterloo
Southwark
Lambeth North
Borough
Elephant & Castle
Kennington Oval
Stockwell
Clapham North
Clapham Common
Clapham South
Balham
Tooting Bec
Brixton
West Finchley
Finchley Central
East Finchley
Highgate
Archway
Tufnell Park
Arnos Grove
Bounds Green
Wood Green
Buckhurst Hill
Roding Valley
Chigwell
Grange Hill
Woodford
Upminster
Bridge
Reach
Beckton
Northern
Piccadilly
Victoria
Circle
District
East London
Connections with National Rail within walking distance
Connections with riverboat services
Airport interchange
Closed Sundays

Distance Cartogram (another view)

https://www.archdaily.com/159195/london-relaunches-tube-map



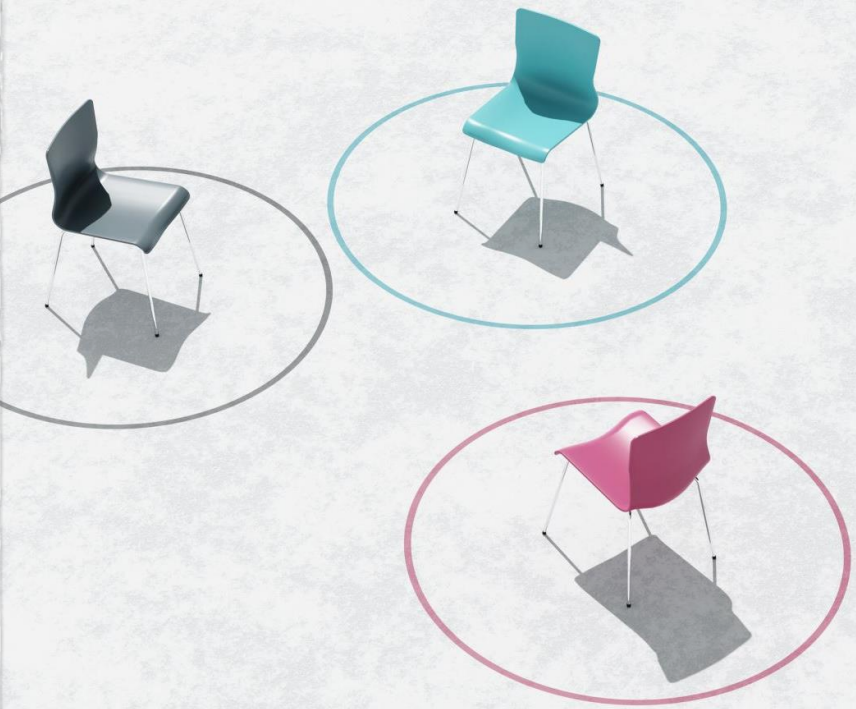


Distance Cartogram as metaphor

The metro of science,
http://bibliomaravm.blogspot.com/2010/11/metro-da-ciencia.html

Isochrone maps

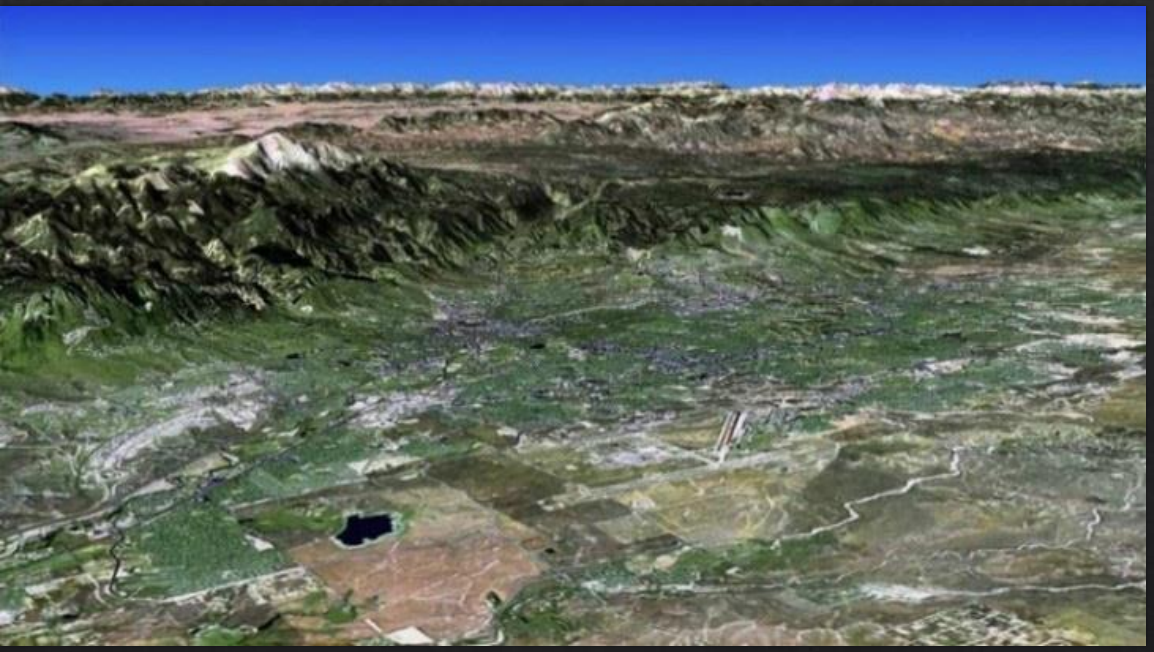
- Isochrone lines; an analogy to contour lines (isarithmic maps)
  - They are nothing new.
  - Open Healthcare Access Map, the Heidelberg Institute for Geoinformation Technology



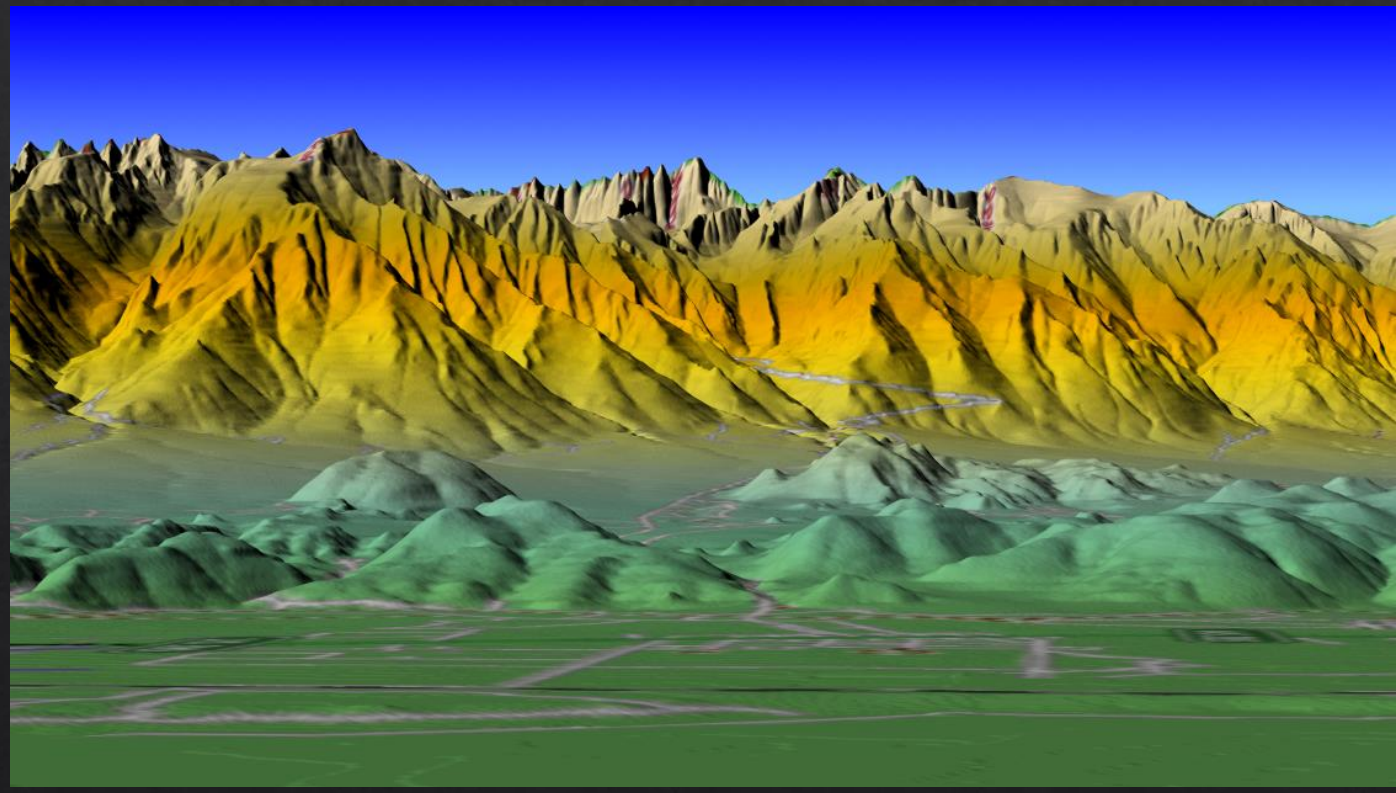
3D Geovisualization

- Often, the term "3-dimensional" is confused with that of "2.5-dimensional".
- 3D visualization is closer to the way humans perceive real and familiar 3d space that surrounds them.
- However, it also presents disadvantages such as the limited view field, resulting into hiding a part of the representation space.
- The way to interact with the geovisualization environment is usually more complex and requires more time for the user to get used to.

3D Geovisualization Examples



https://upload.wikimedia.org/wikipedia/commons/a/a7/Colorado_Springs_3D_Map.jpg



https://upload.wikimedia.org/wikipedia/commons/0/03/MtWhitney.png

Spatio-temporal Visualization - I

Defined as the visualization that depicts the change of spatial data over time. Depending on the type of this change, spatio-temporal geovisualizations can be distinguished into those that:

- Spatial objects are created and/or disappear in time.
- Spatial properties (location, shape, size, etc.) of objects change over time.
- Thematic changes occur, that is, the non-spatial characteristics of objects change over time.

Spatio-temporal Visualization - II

- Animation is widely used in the visualization of meteorological data and phenomena, since the variability of the weather is an ideal example of the use of such a visual rendering method.
- The existence of a huge amount of information on the internet coupled with the explosion of the use of social networks have contributed to the creation of animations that expand the range of topics covered by traditional maps.

Spatio-temporal Visualization – III
Animation Examples

- Animation showing the rainfall during 20 - 27 July 2009 in Japan.
- Animation showing the 2004 Pacific earthquake tsunami.

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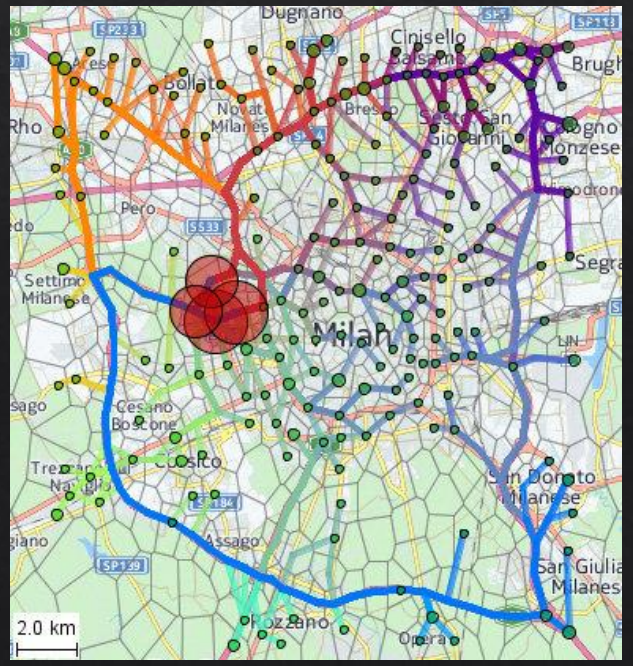
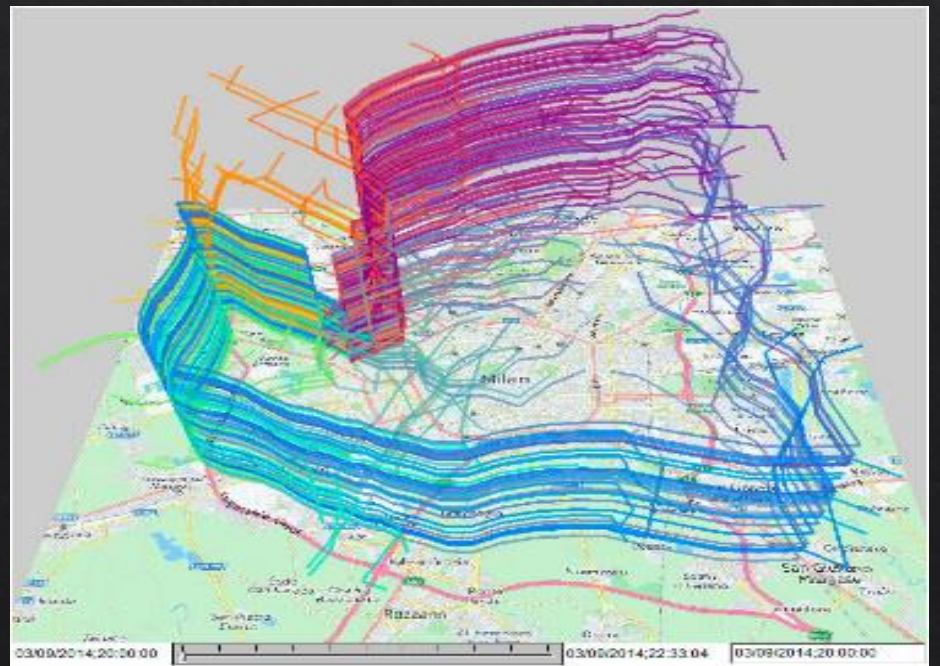
Spatio-temporal Visualization – IV

- Alternatively, creating several consecutive snapshots allows comparing situations at different points in time.
- Another way is to visualize the changes as time-series graphs linked to specific locations in the representation space.
- Finally, the visualization of the changes that take place over time can be achieved using the third and vertical dimension, in which case the so-called space-time cube is created.

Examples

- Animated map depicting the average monthly temperature in Italy.
- Animated map depicting cumulative cases of covid19 worldwide
- Beacon map showing all the blinking beacons from OpenStreetMap.
- Space-time cube

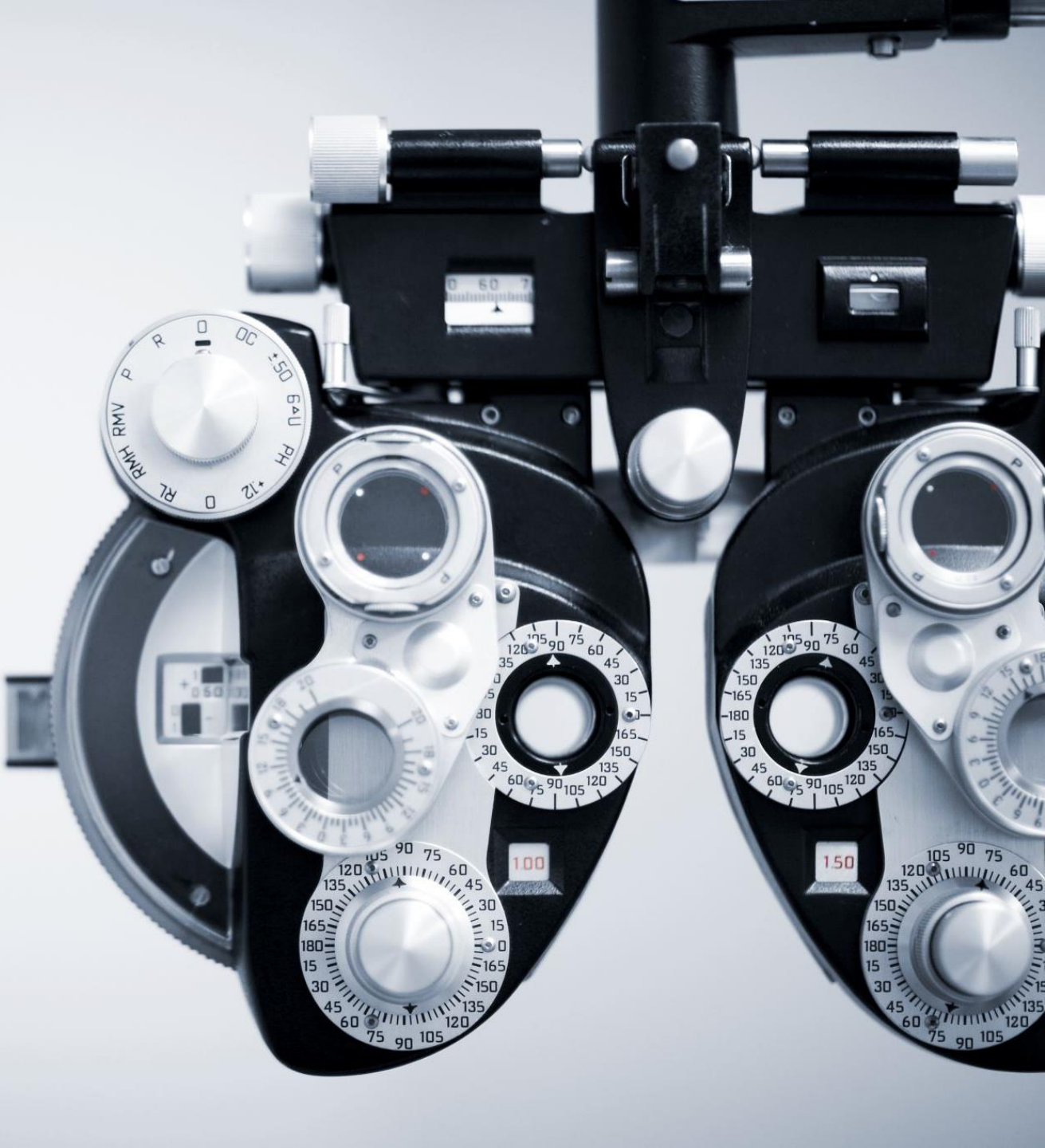




Andrienko N, Andrienko G, Rinzivillo S. Exploiting Spatial Abstraction in Predictive Analytics of Vehicle Traffic. ISPRS International Journal of Geo-Information. 2015; 4(2):591-606. https://doi.org/10.3390/ijgi4020591

Geovisualization and other sensory modalities

- Vision – visual variables
- Hearing –sound variables Example
- Touch – haptic variables Example
- Olfaction ???
- Taste ???



number of refugees in relation to the country's annual salary

refugees as proportion to the country’s population

number of displacements due to natural disasters

number of deaths due to natural disasters

Geovisualization and Augmented Reality