

Cours de Visualisation d'Information

InfoVis Lecture

Maps & geographical representations

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Inspired from Geog486 <https://www.e-education.psu.edu/geog486/> (A Gruver)

Inspired from CS 7450 - Information Visualization (J. Stasko)

Outline

- Maps
- Choropleth
- Heatmaps
- Graphs on map
- Cartograms



Maps

2D, old and
so heterogeneous

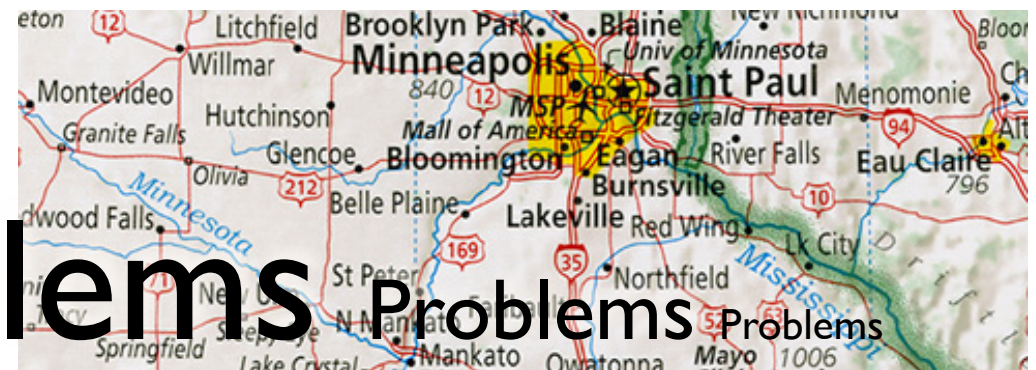
[??? - 1400BC]



- Many graphical cues (points, lines, areas, texts)
- Distinguishing marks (road/river, park/state name)
- Levels (county/state, peak/mountain range)
- Natural vs Artificial marks (river vs county limit)
- Shading (... 3D like)
- Text (names) Numbers (altitude) and Symbols (plane)

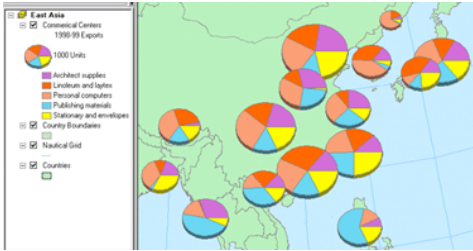


[National Geographic Political map]



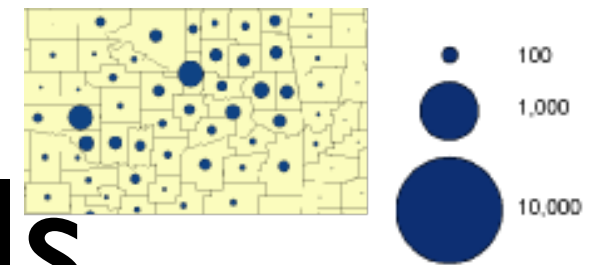
[Essential Geography of the USA]

- Problem of labels (where ? occlusion !)
- rivers=curve city=area peak=point
- Problem of density & coherence
 - Always display road names => too much (cities)
 - Display only highway names => desert
 - Display road names only away from cities (consistency ? is the limit obvious ?)
- How to display quantitative or abstract data ?

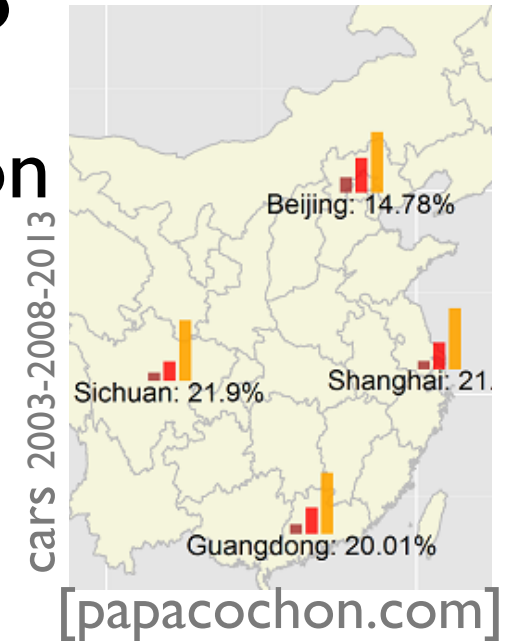


[ArcGIS help]

Maps + symbols



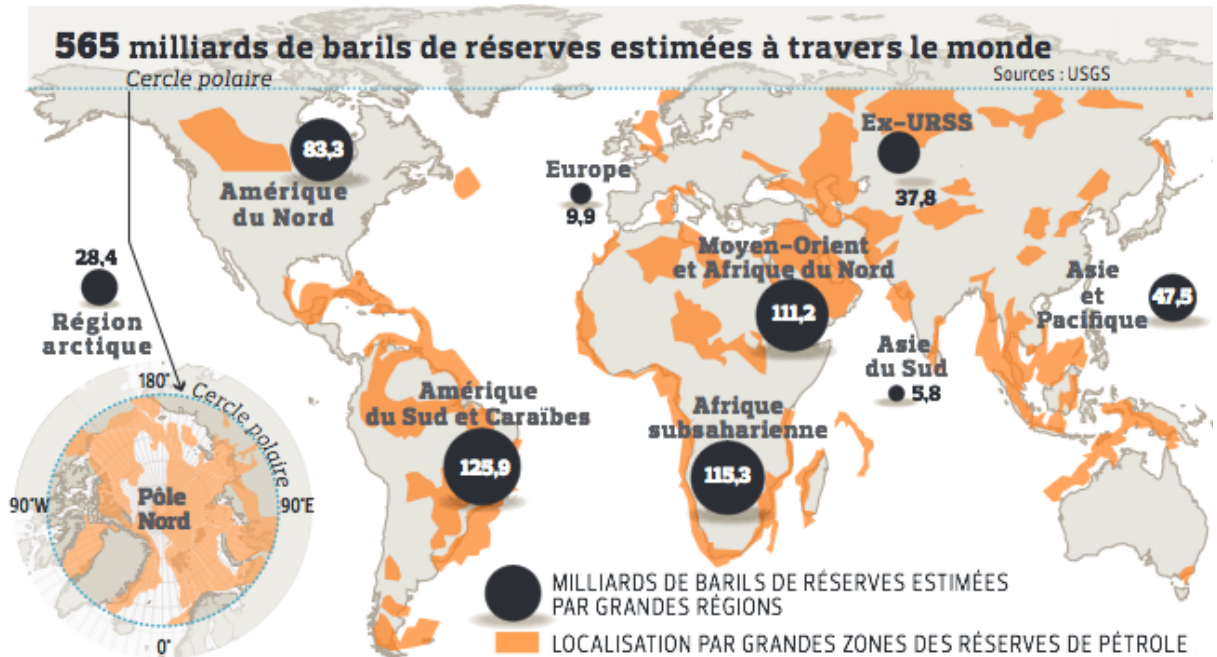
- Split quantity and geographic area/location
- Quantity = length or area ? linear/log ?
- Aggregation function / colors



[J. Snow 1854. Cholera map London]



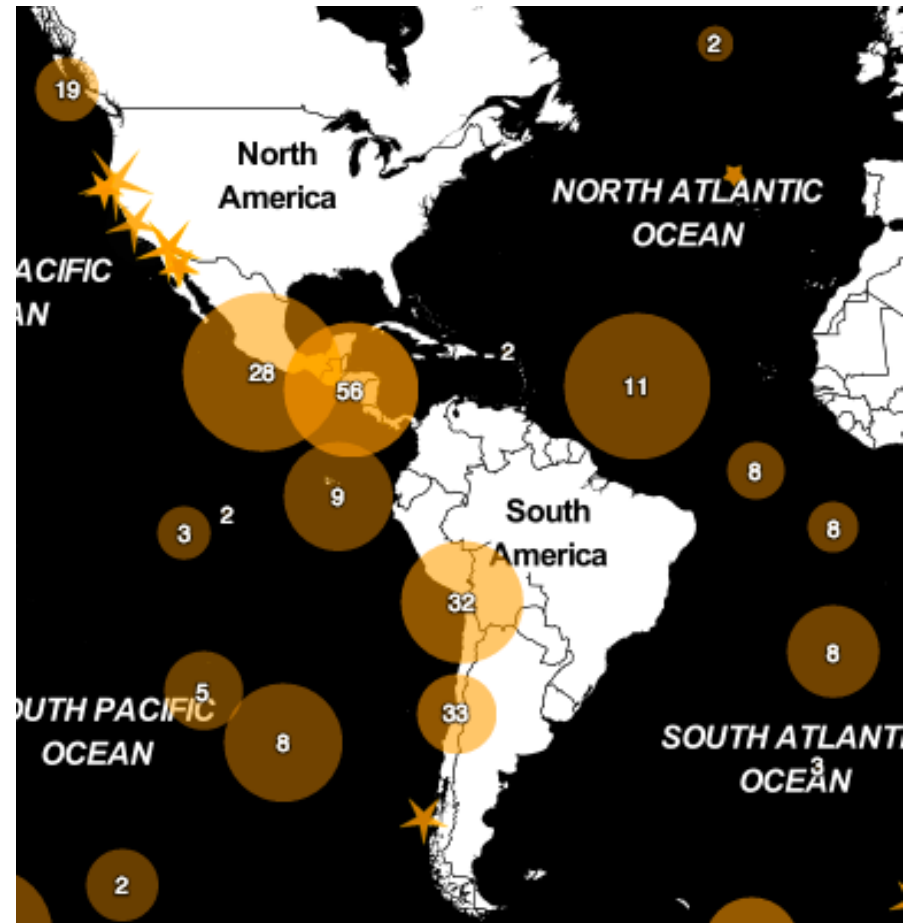
[Figaro]



Example: criticize...

<http://openlayers.org/en/v3.2.1/examples/earthquake-clusters.html>

- OpenLayer Toolkit
- Zoom
- Multilevel Aggregation
- Interaction (hover)
- Labels
- Size ?



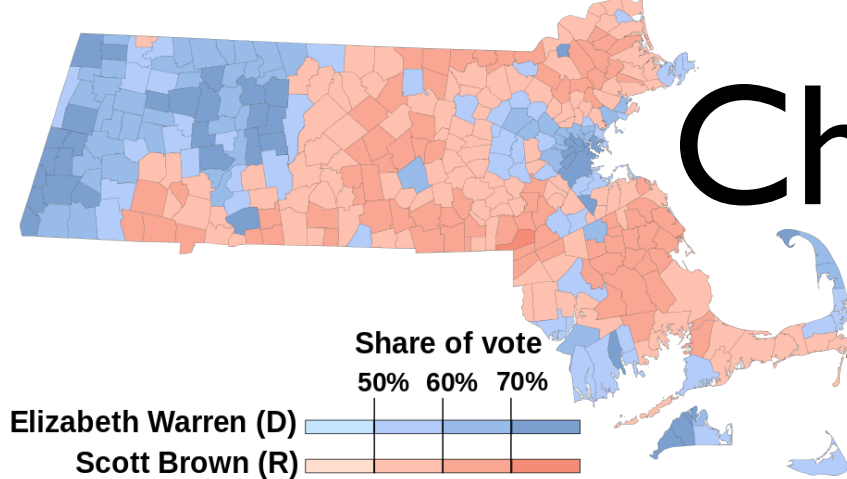
Zoomable maps

- Levels of detail
- Moving labels
- Continuous / Discrete steps / Hybrid
 - Animation, transparency, scale (2x ?>? 1.9x)
- Navigation becomes key factor (pan&zoom)
 - Lost in desert, unwanted move => minimap/overview
- Scaling central point (zoom and unzoom)

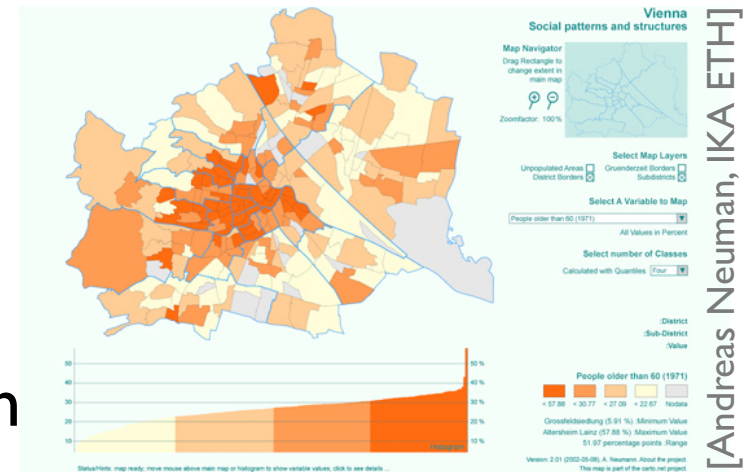
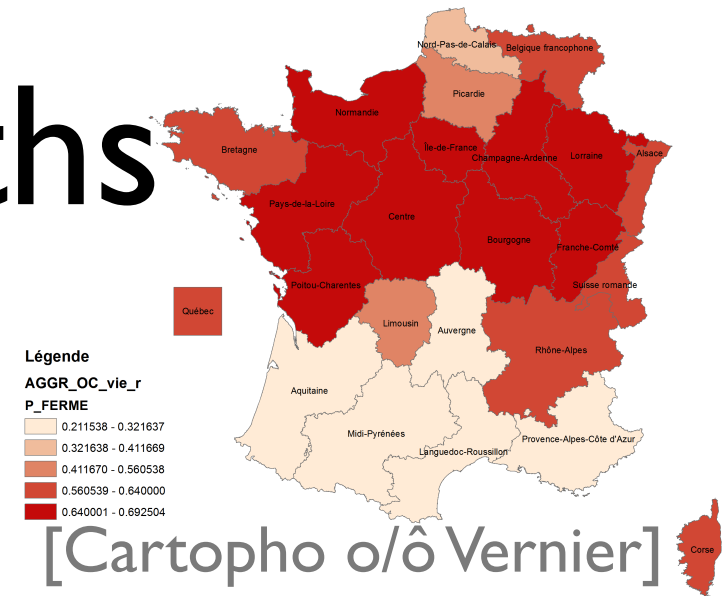


<http://www.amcharts.com/demos/zooming-to-countries-map/>

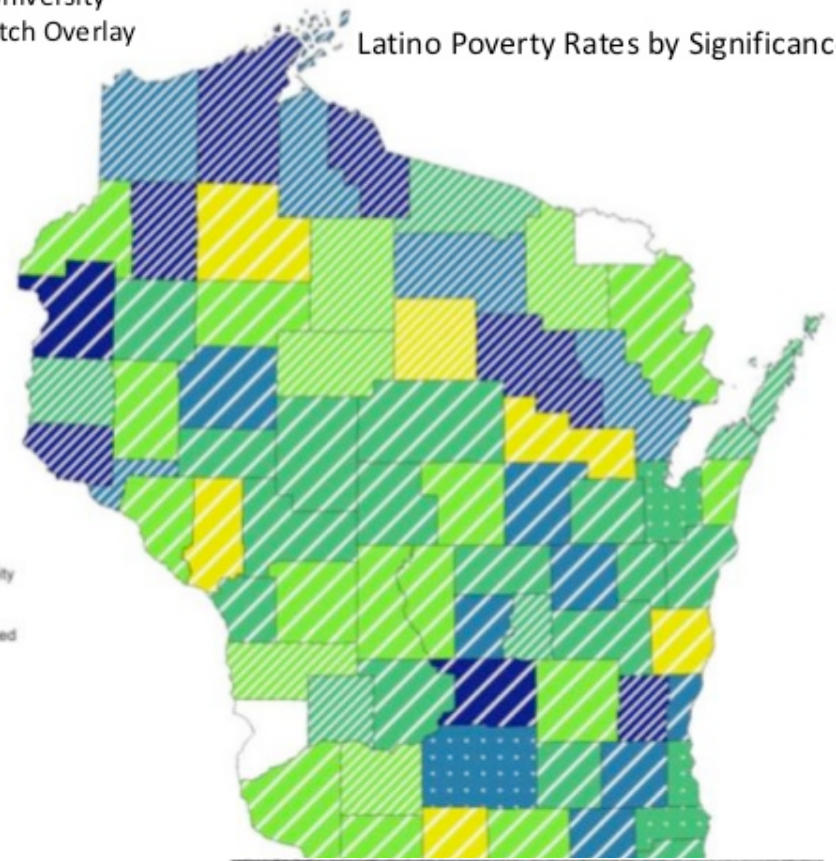
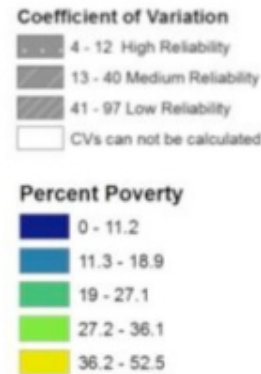
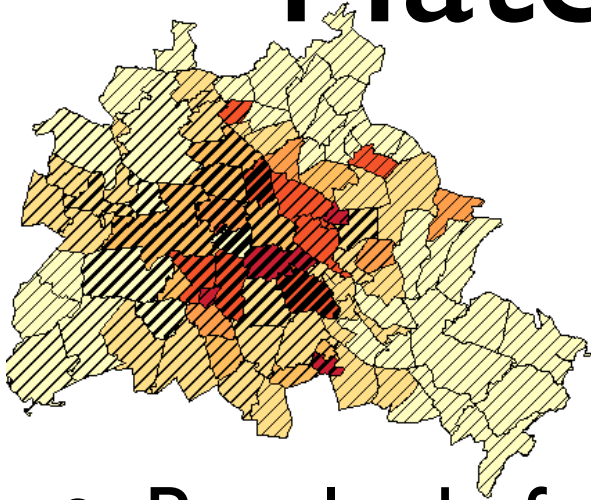
Choropleths



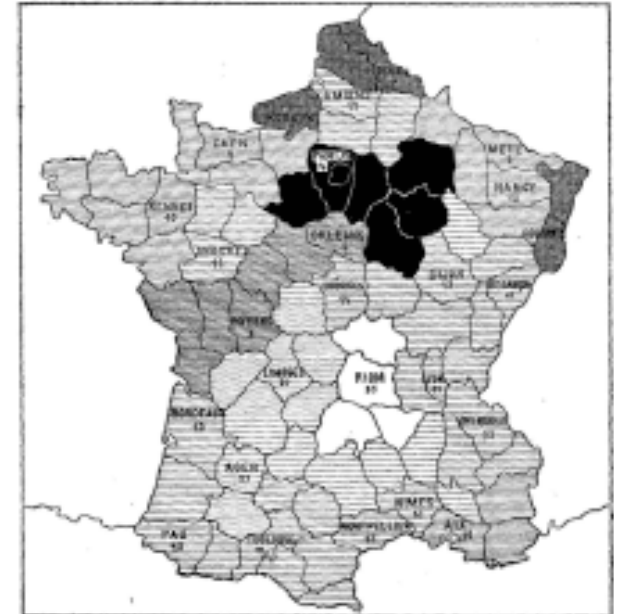
- Quantified dimension on map
- Ratios >> absolute values
- Colored Areas and labels
- Legend (color coding)=>histogram
- Choosing the right color scale (<http://colorbrewer2.org/>)
- Level of detail (aggregation state/county)



Choropleth Hatching

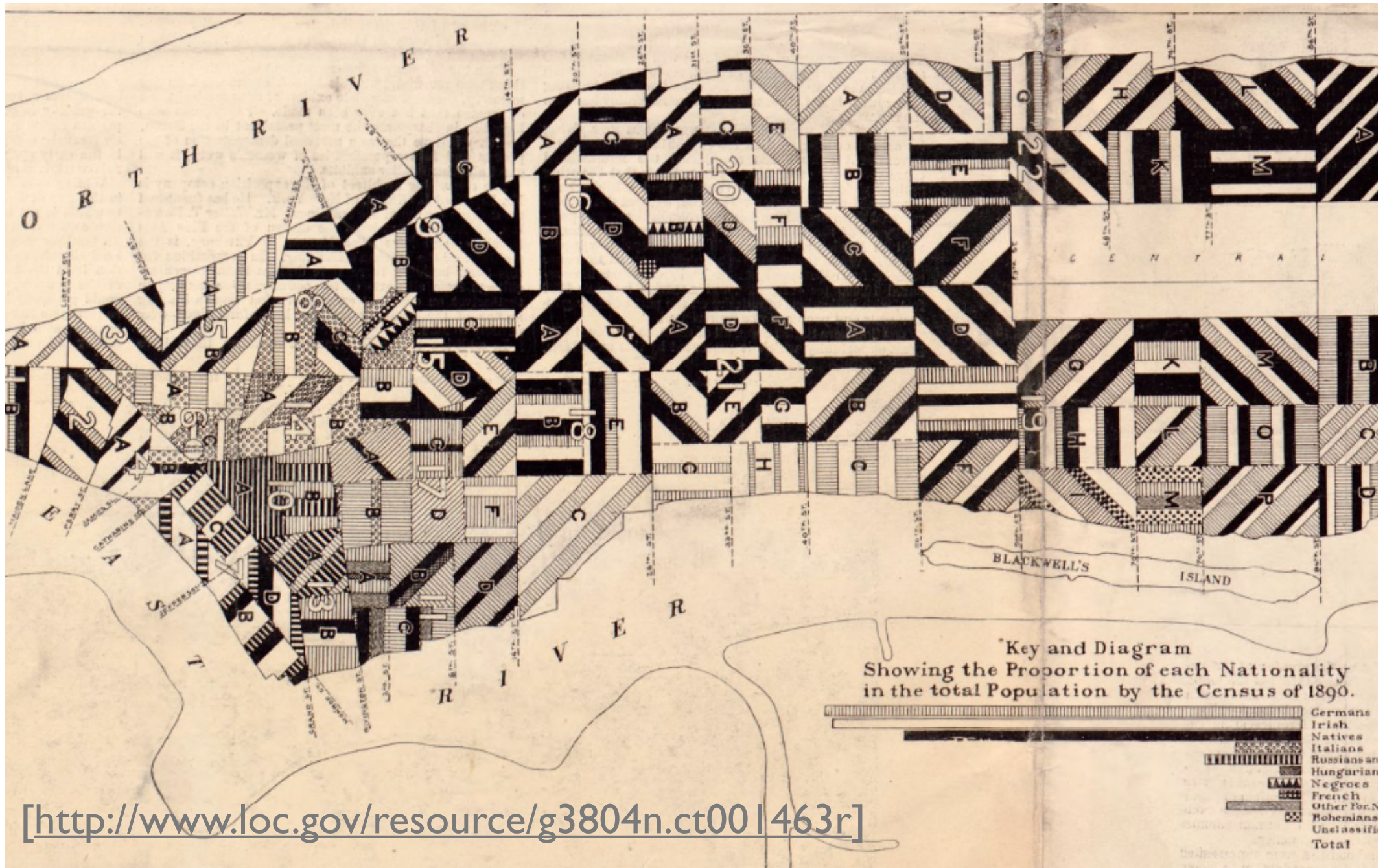


- Popular before color
- Can display more than one dimension
- Color + Angle(0-90) + Density ?
- Draw attention on filled areas
- Darker = more, lighter = less



[Literacy C. Dupin 1826]

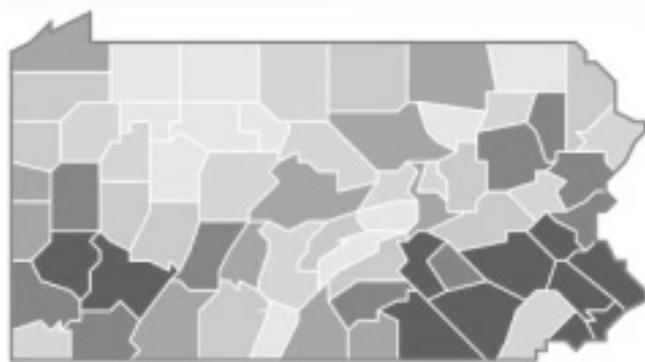
10D = 10 hatchings



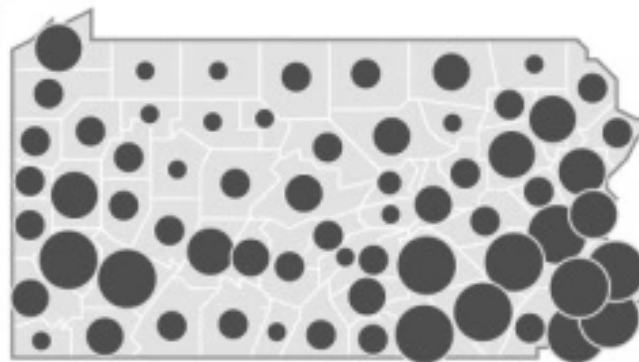
Choropleth vs proportional perception

[papacochon.com]

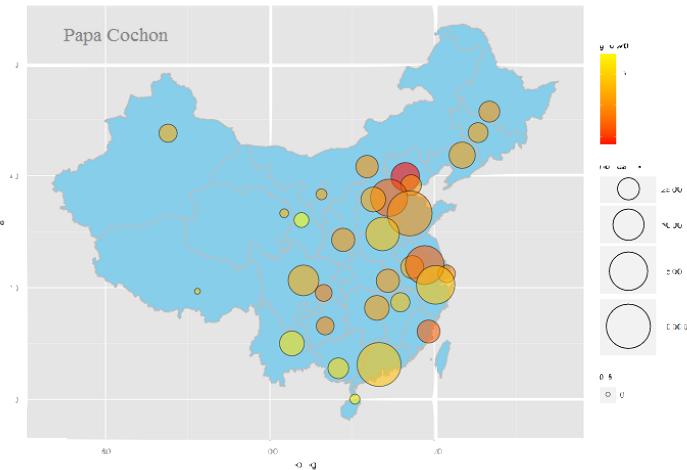
color on symbols [R tutorial]



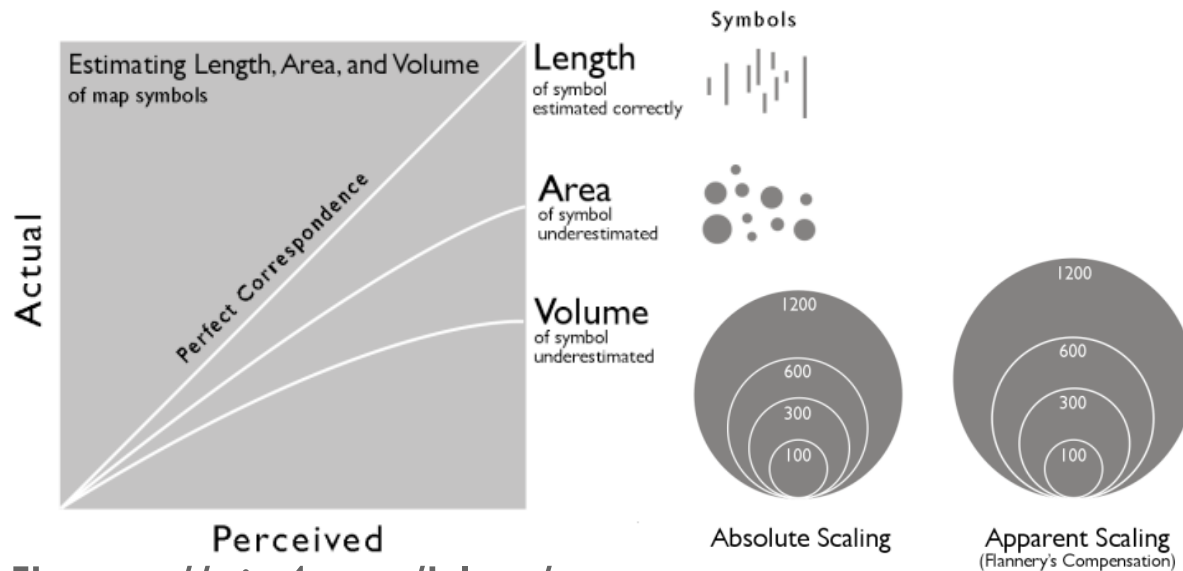
darker means more, lighter less



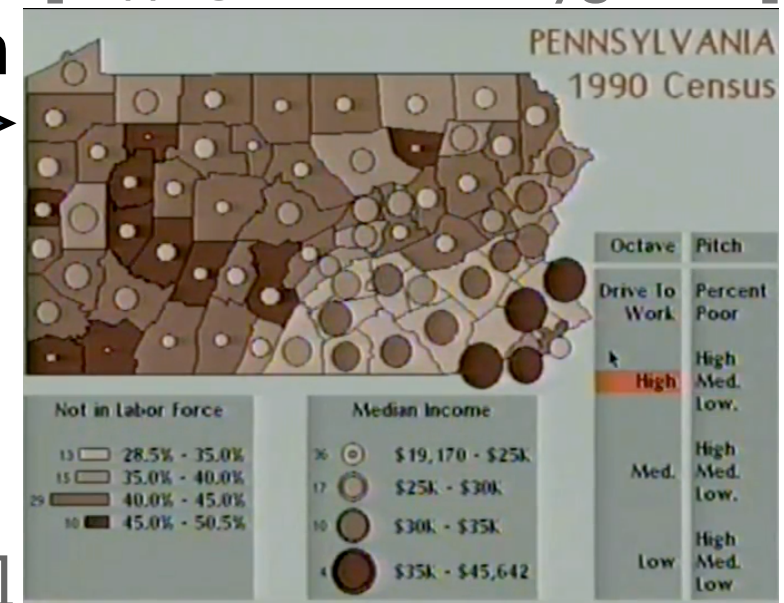
larger circles mean more, smaller less



[Mapping with sound Krygier 93]



Both

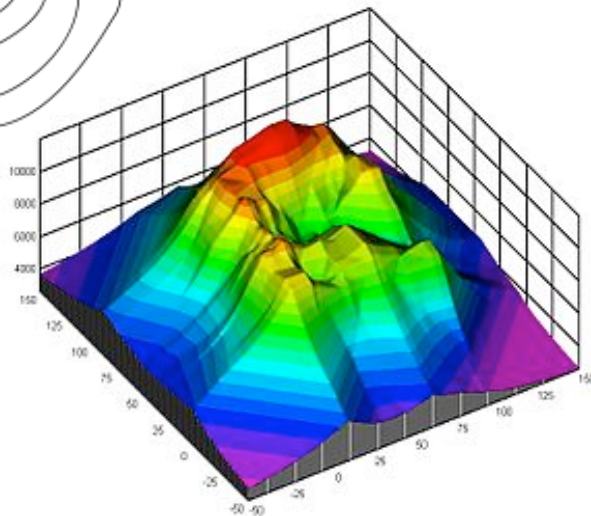
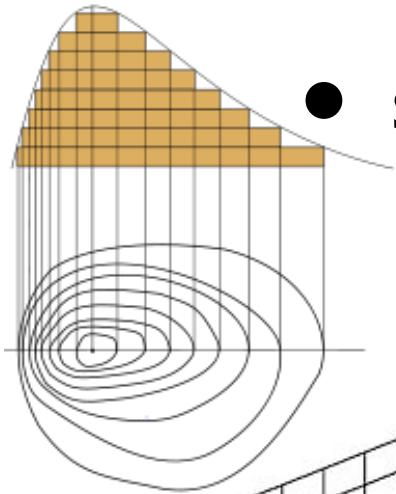


[<https://vis4.net/blog/posts/mapping-data-to-circles/>]

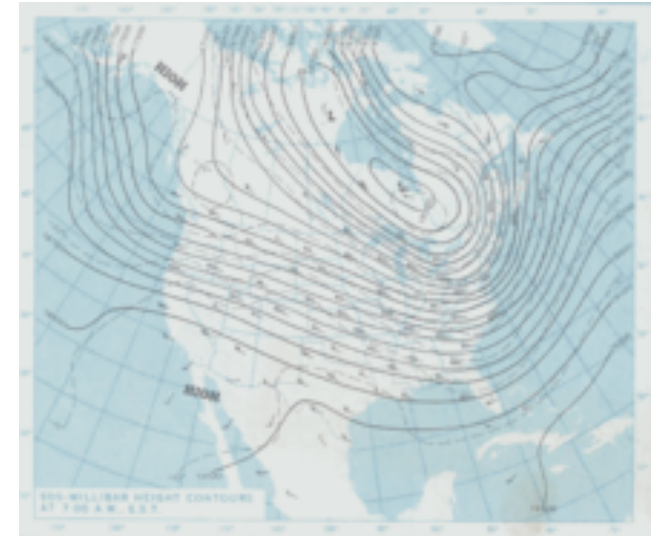
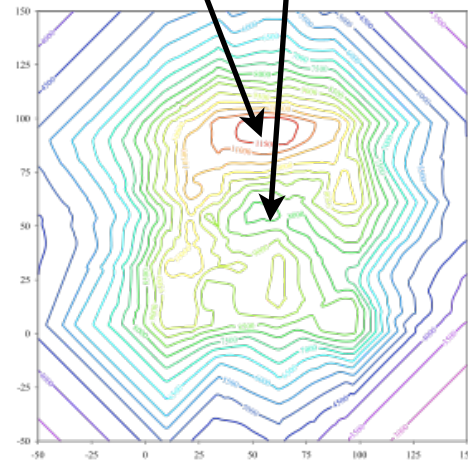
[<http://makingmaps.net/2007/08/28/perceptual-scaling-of-map-symbols/>]

Contour maps

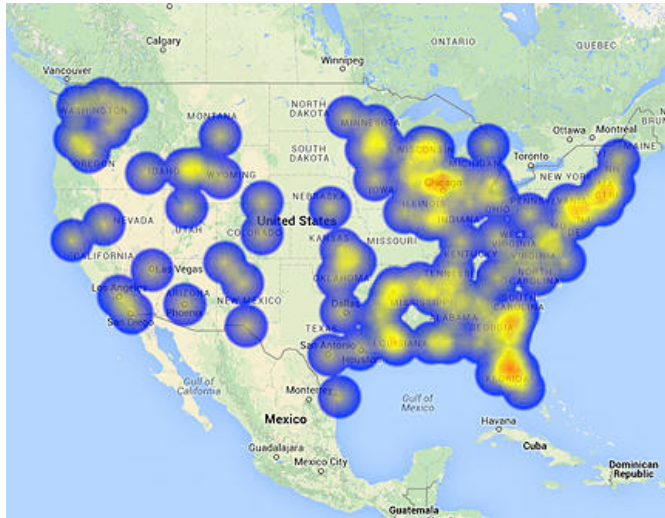
- Isoline, Isarithm or Isopleth
- Distinguish local highs and lows ?
 - colors / text
 - saddle points ?



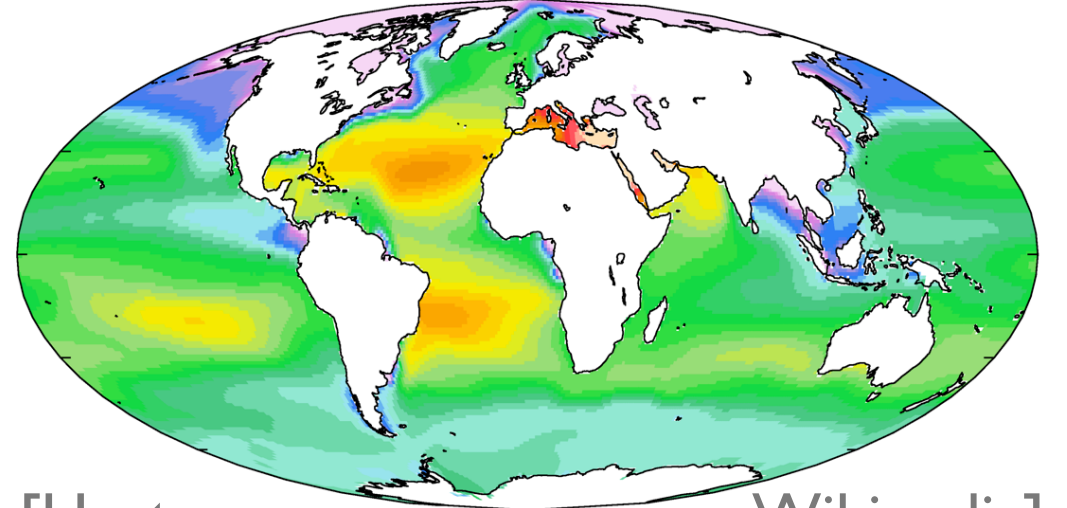
=



Heatmaps

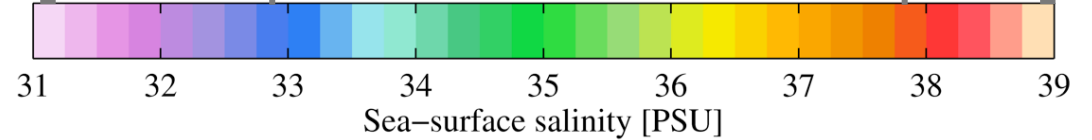


[eSpatial]

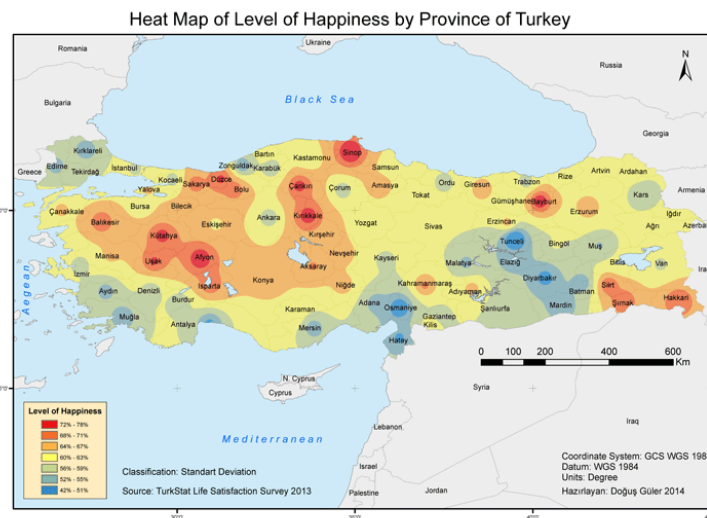


[Heatmap]

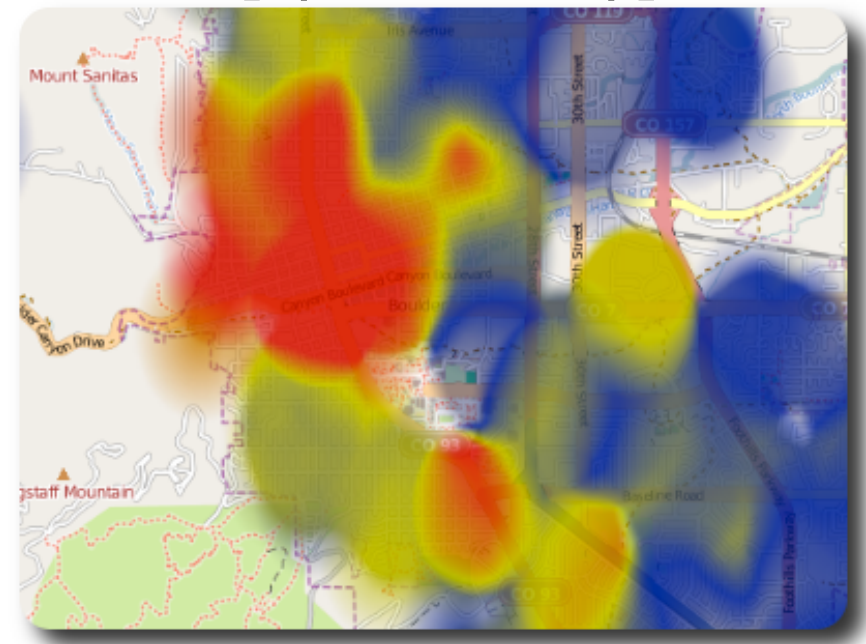
Wikipedia]

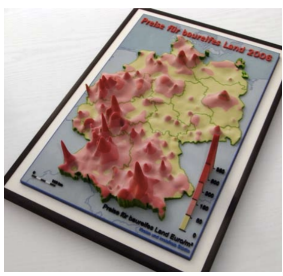


- Color scale ? no rainbow !
- Hide background map
- Contour /Discrete
- Legend



[openHeatMap]





[real estate price in germany]

[pop. of Mexico City]

Physical maps

[Abigail Reynolds. Mount Fear East London.]



- Elevation represents the rate of violent crimes between 2002 & 2003 (East London)
- contour lines
- 3D printers

more at <http://dataphys.org/list/tag/cartographic/>

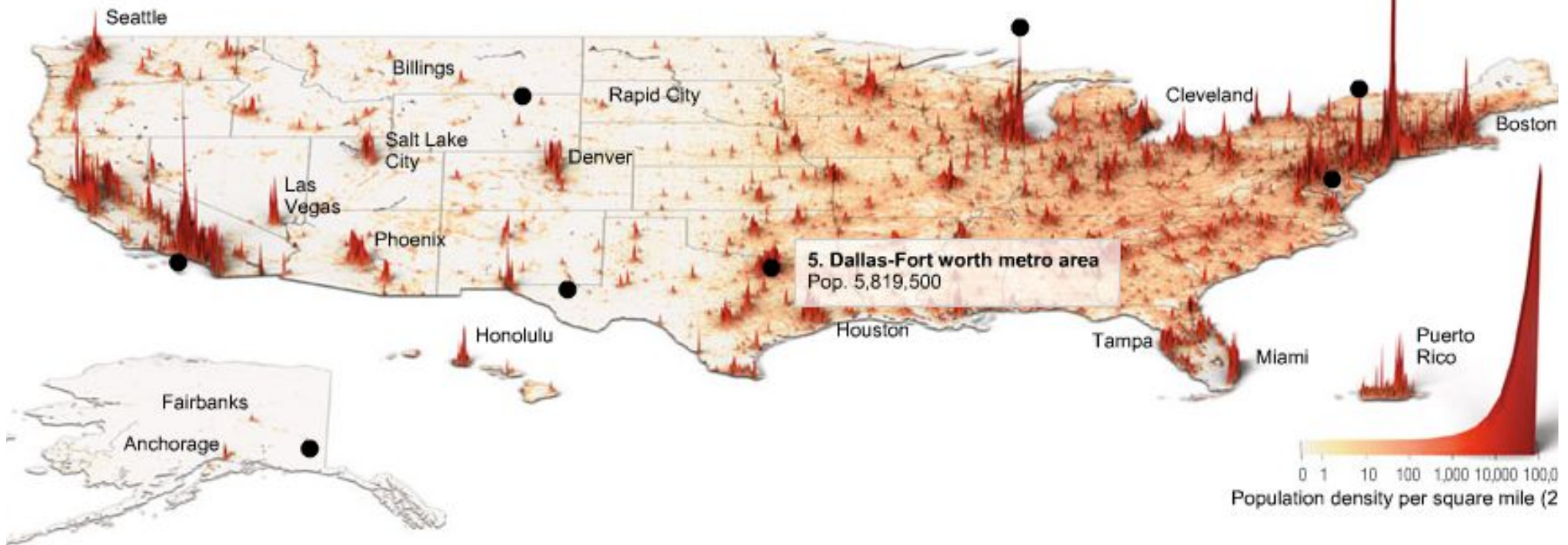
3D heatmaps

This Is Where We Live

Take a look at America by the numbers.
Roll over the map to learn more»

SOURCE & CRI

80% of the U.S. population lives in a metropolitan area. Top five population centers are numbered



http://www.time.com/time/covers/20061030/where_we_live/

Graphs on map

- Relate geographical positions

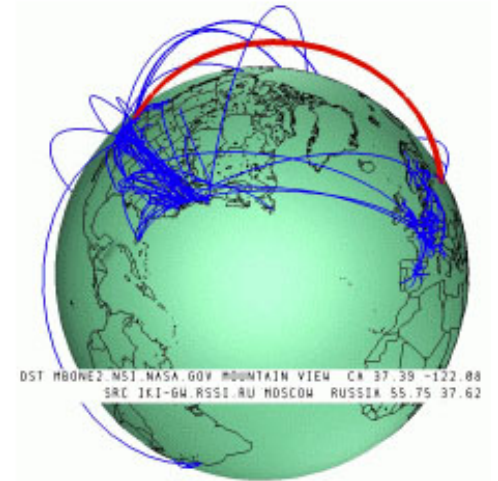
- routes do not really matter

- arcs vs straight lines

<http://www.amcharts.com/demos/map-with-curved-lines>

- arrows vs triangle for directed graphs

neat ! but almost useless



[CAIDA Munzner]

World Trade

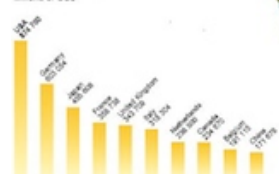
Trade Organizations

- LAIA/LACI
- APEC
- CARICOM
- ECOVAS/CEDEAO
- MERCOSUR
- OECD
- OPEC
- Andean Community
- NAFTA
- EU

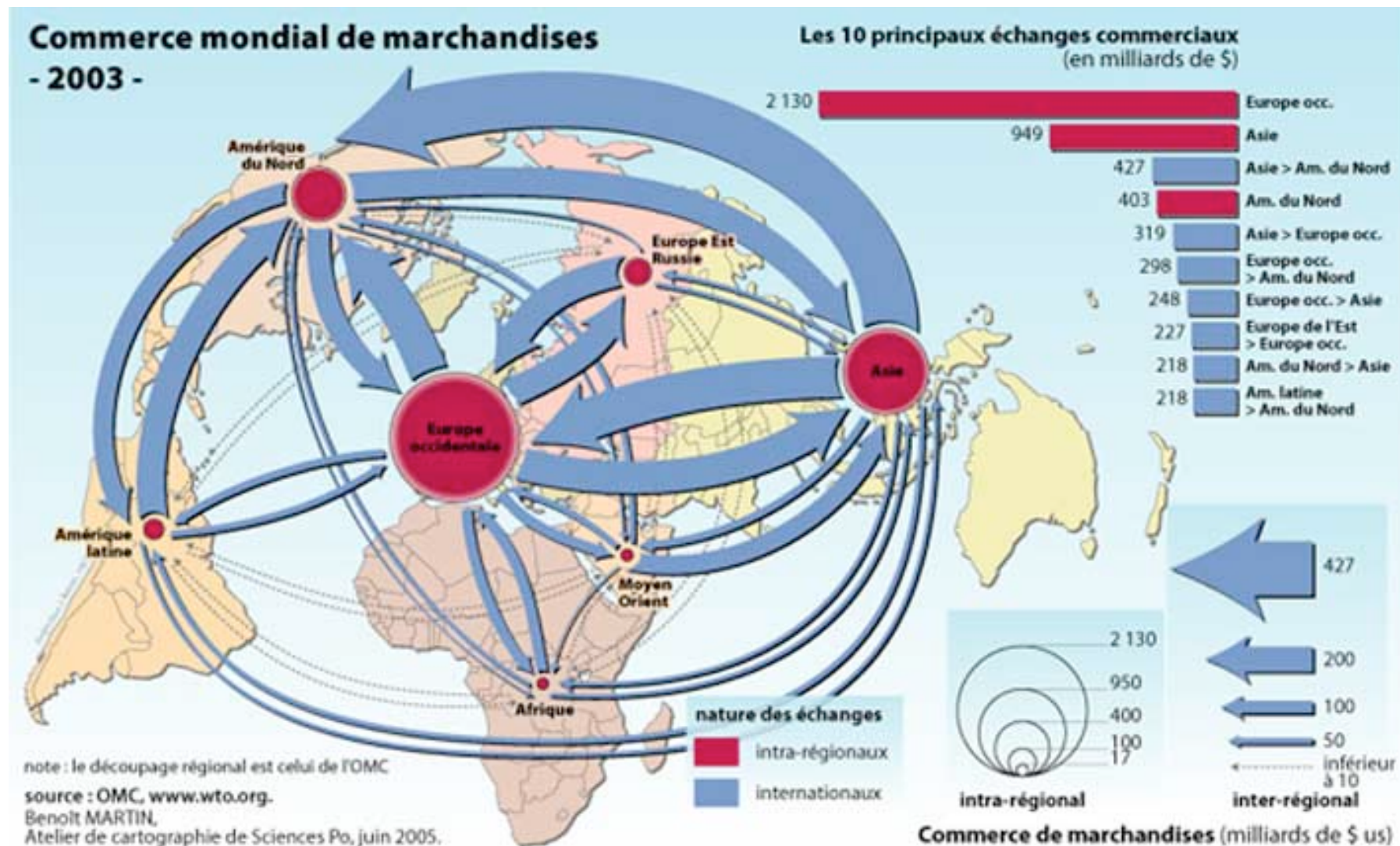
Trade Exchanges

- Less than 25 millions of US\$
- Between 25 and 40 millions of US\$
- Between 40 and 80 millions of US\$
- More than 80 millions of US\$

Major Exporting Countries

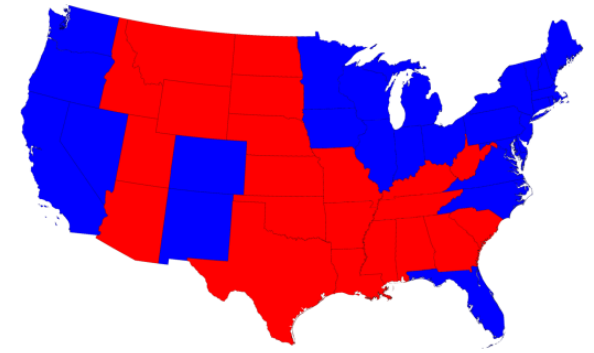


link size matters !

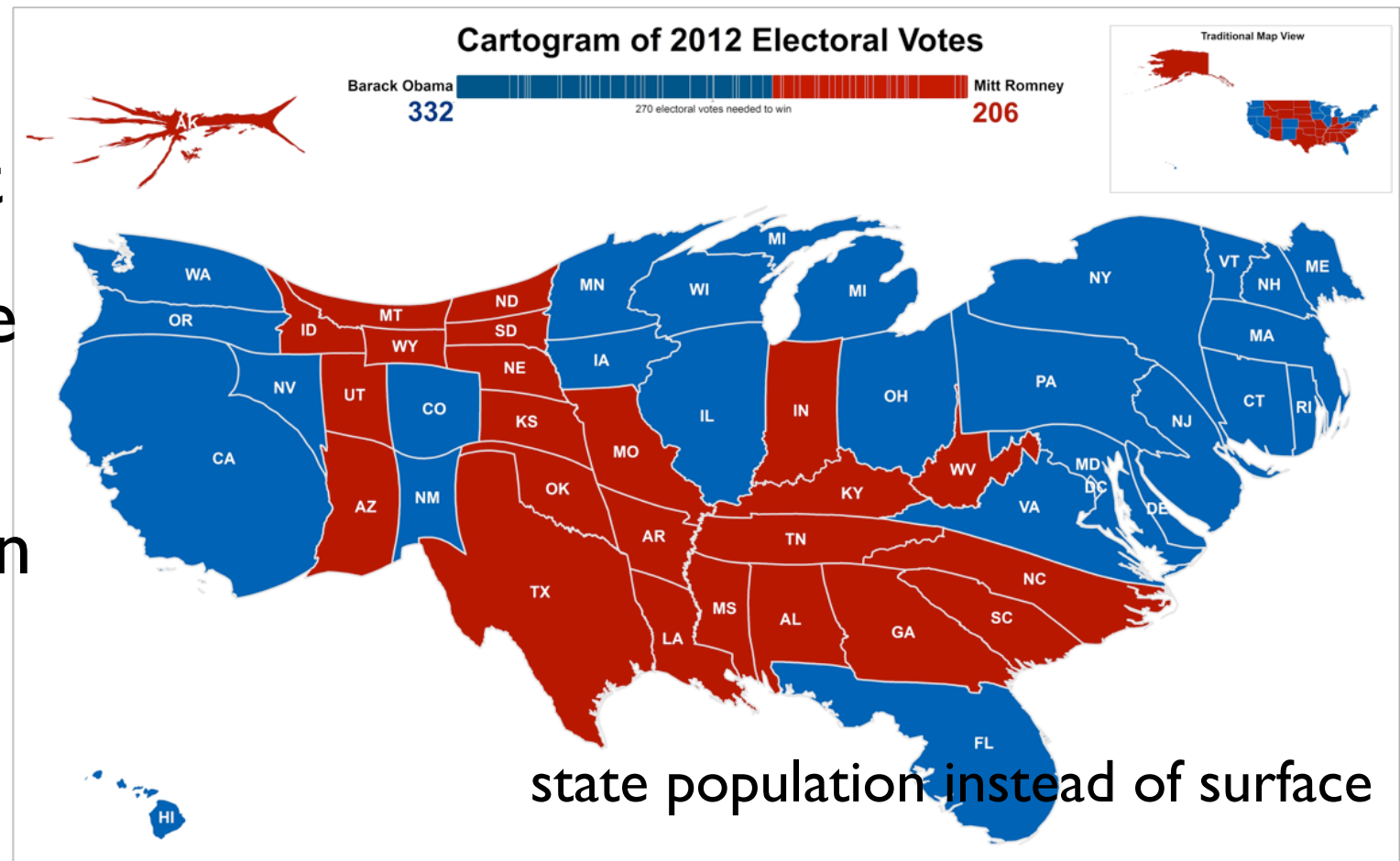


Cartograms

A.K.A. Anamorphoses

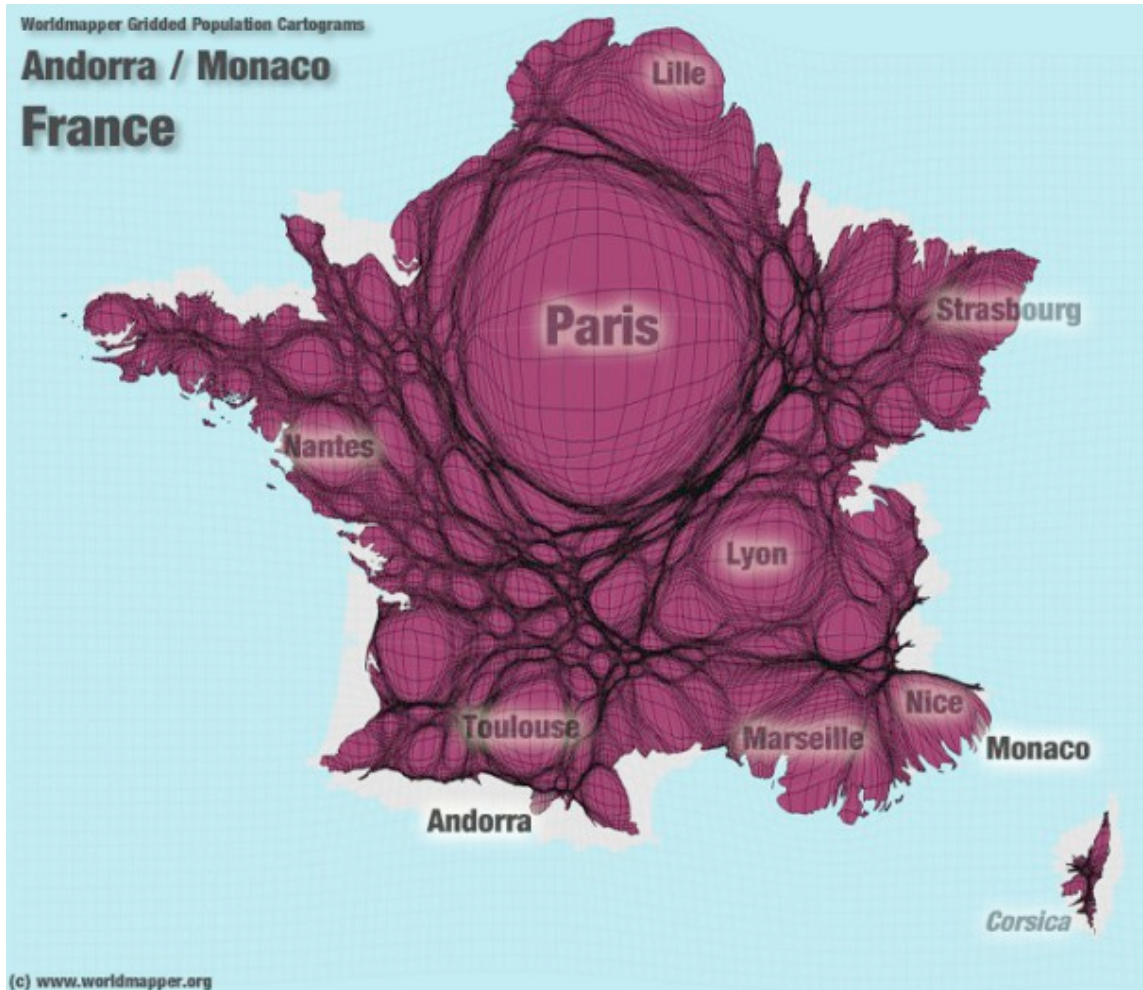


- Deform space to fit quantified data
- Task / Conclusion more important than map truth
- Do not fit any dataset
- Need more labels
- Well known areas

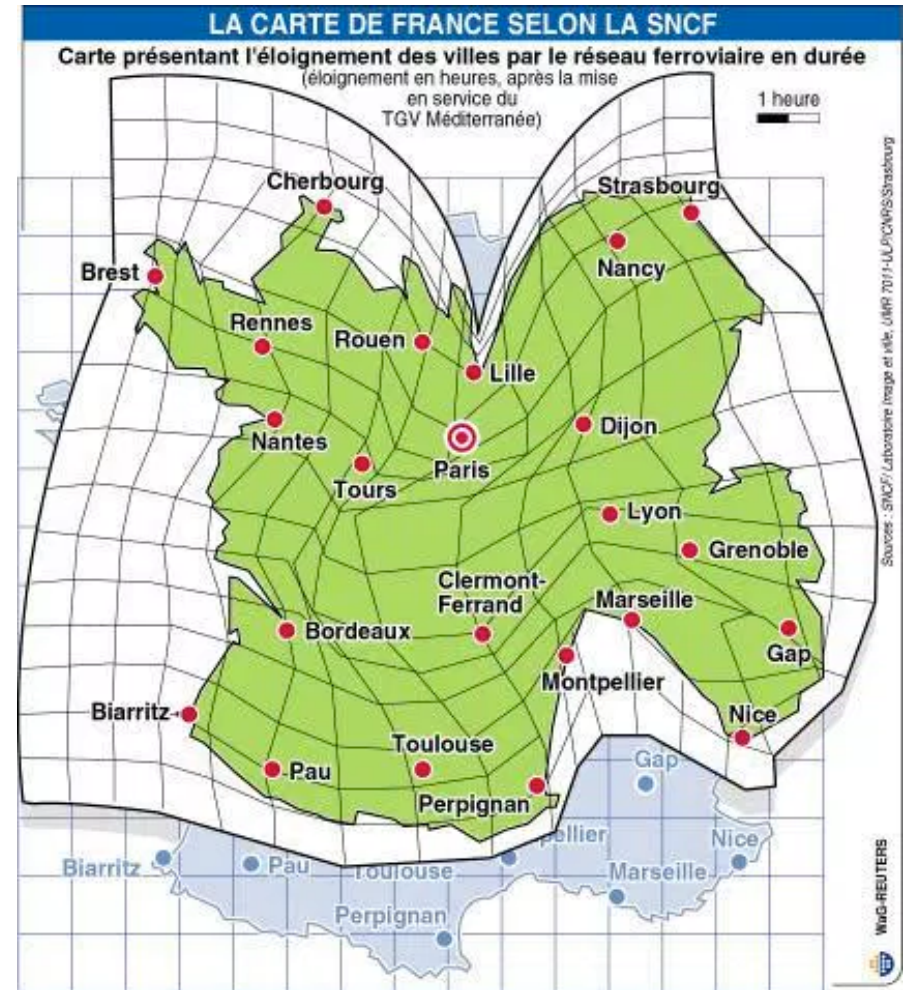


Area vs. Distance

Cartograms



city population instead of surface



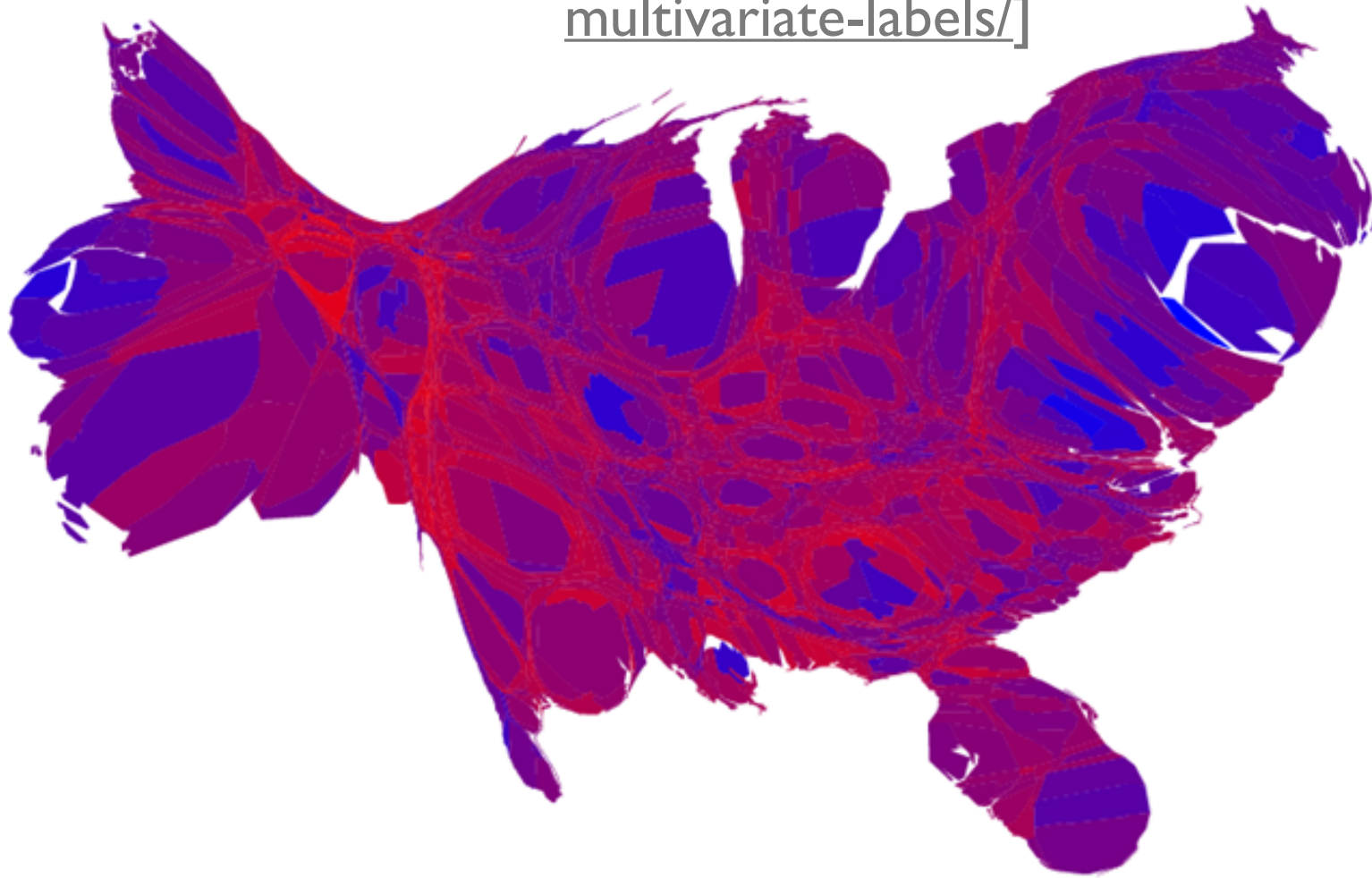
Train schedules instead of km

<http://meridianes.org/2014/07/17/la-france-en-anamorphoses/>

Cartogram + Choropleth

Complementarity

[<https://richardbrath.wordpress.com/2015/10/15/equal-area-cartograms-and-multivariate-labels/>]

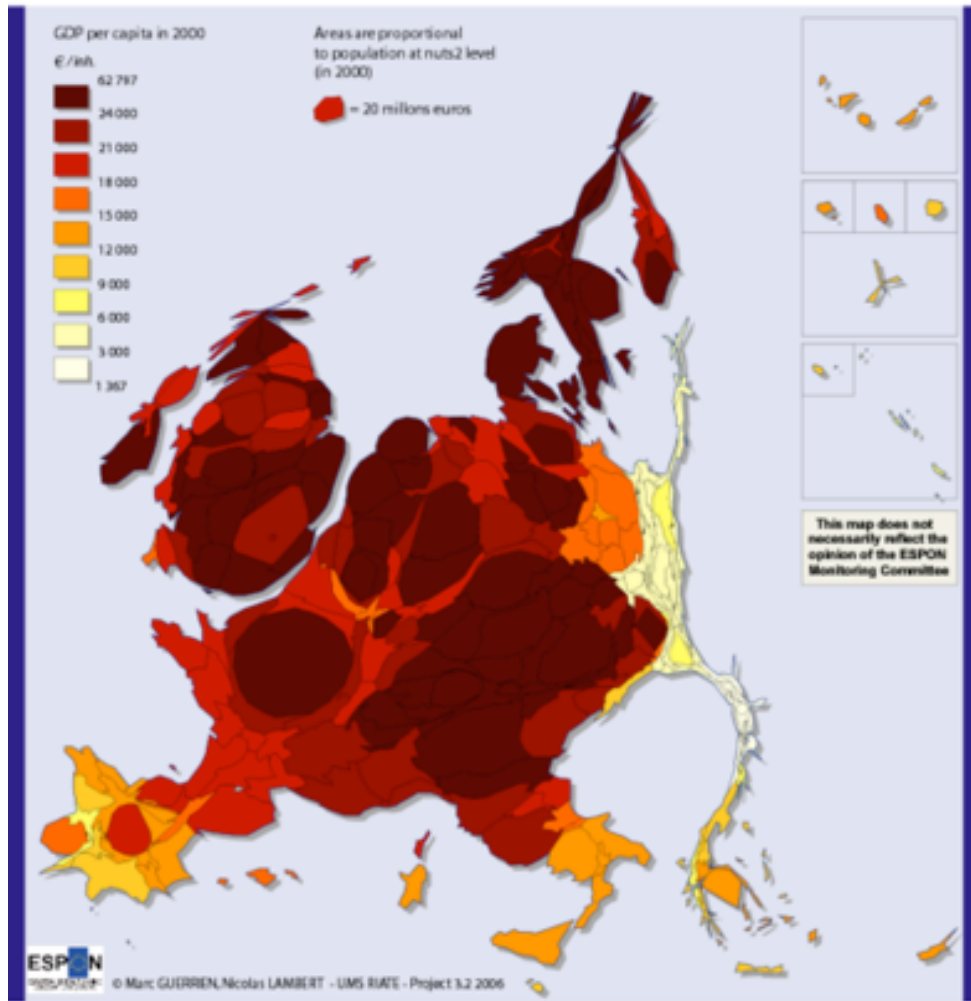


Area cartogram, County size indicates population, shading indicates vote.

Cartogram + Choropleth

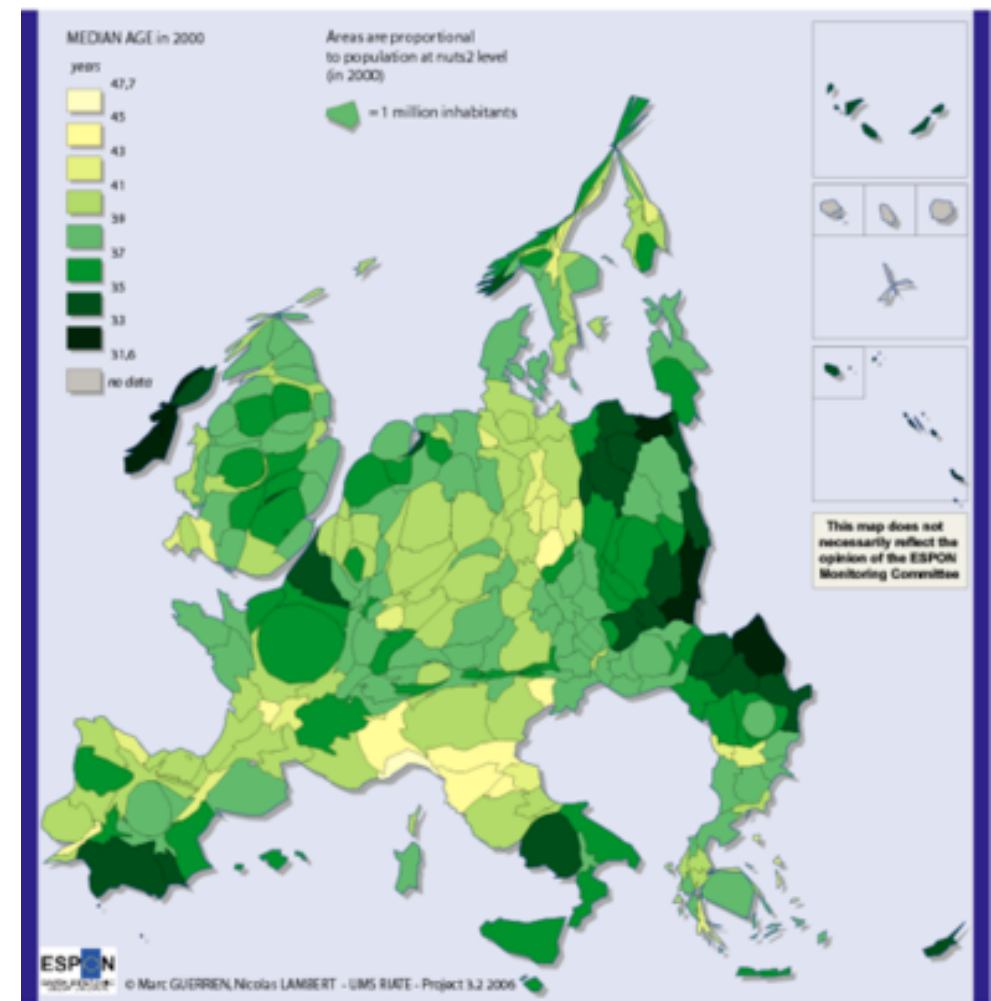
Redundancy

CARTOGRAM AREA OF GDP
AND GDP/capita IN ESPON 29 AREA IN 2000



Source: ESPON Data Base

CARTOGRAM AREA OF POPULATION
AND POPULATION AGEING IN ESPON 29 AREA IN 2000



Source: ESPON Data Base

area AND color = GDP

area AND color = population

Problem: Area = normal area x deformation OR match value ?

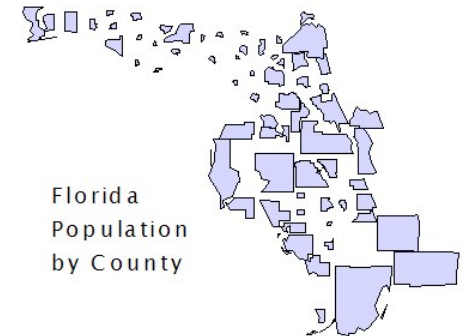
Apportionment / Exploded

[<http://makingmaps.net/2008/02/19/1911-cartogram-apportionment-map/>]

Apportionment Map of the United States

BY WILLIAM B. BAILEY, Ph.D.

ASSISTANT PROFESSOR OF POLITICAL ECONOMY IN YALE UNIVERSITY.

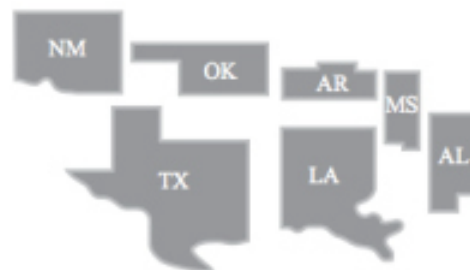


- Outer limits unmodified
- Inner limits reworked

Contiguous (not exploded):



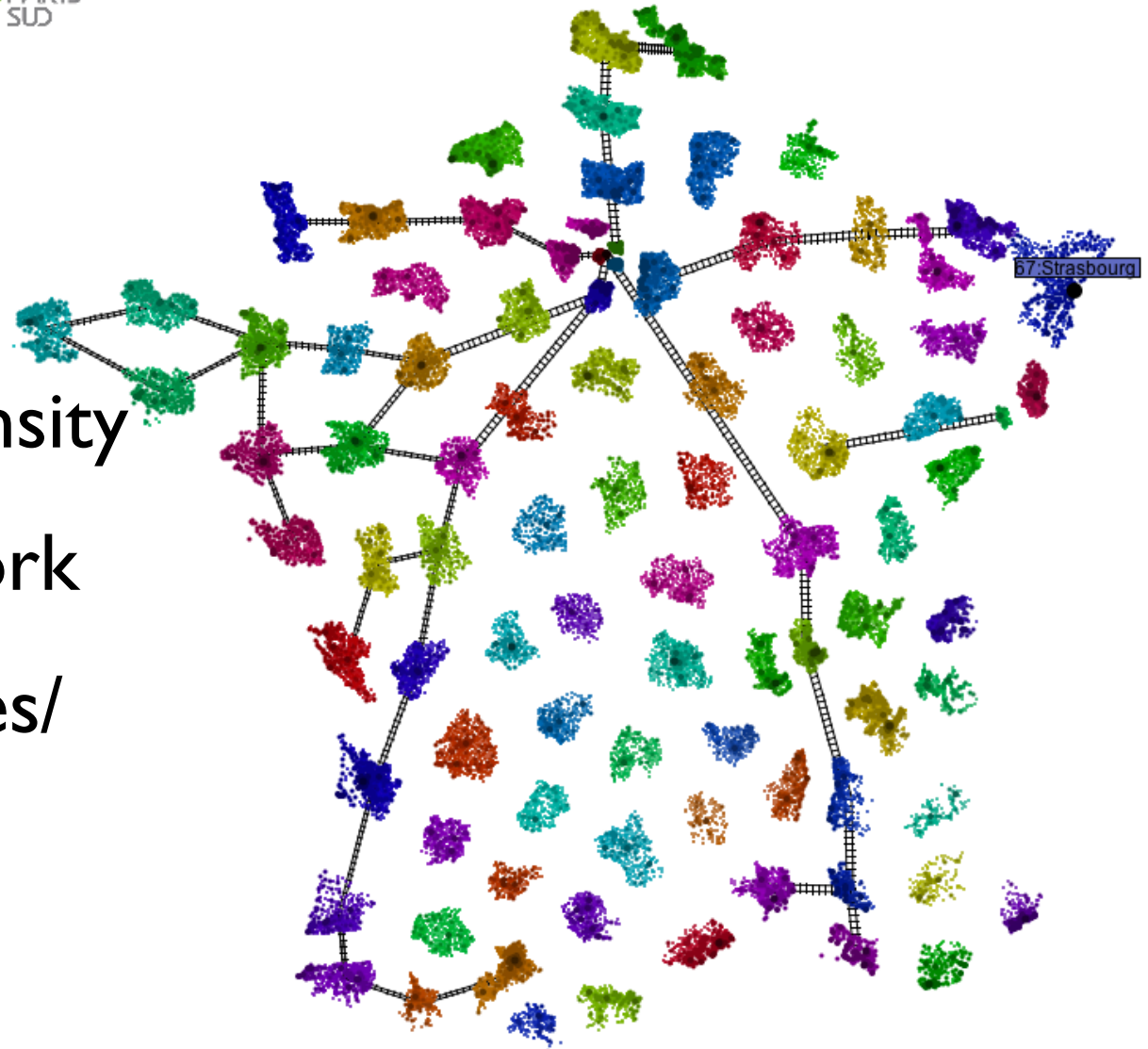
Non-contiguous (exploded):



- Outer limits non contiguous
- Inner limits scaled

F. Vernier contribution 1/6

- population density
- railroad network
- by french states/
departements

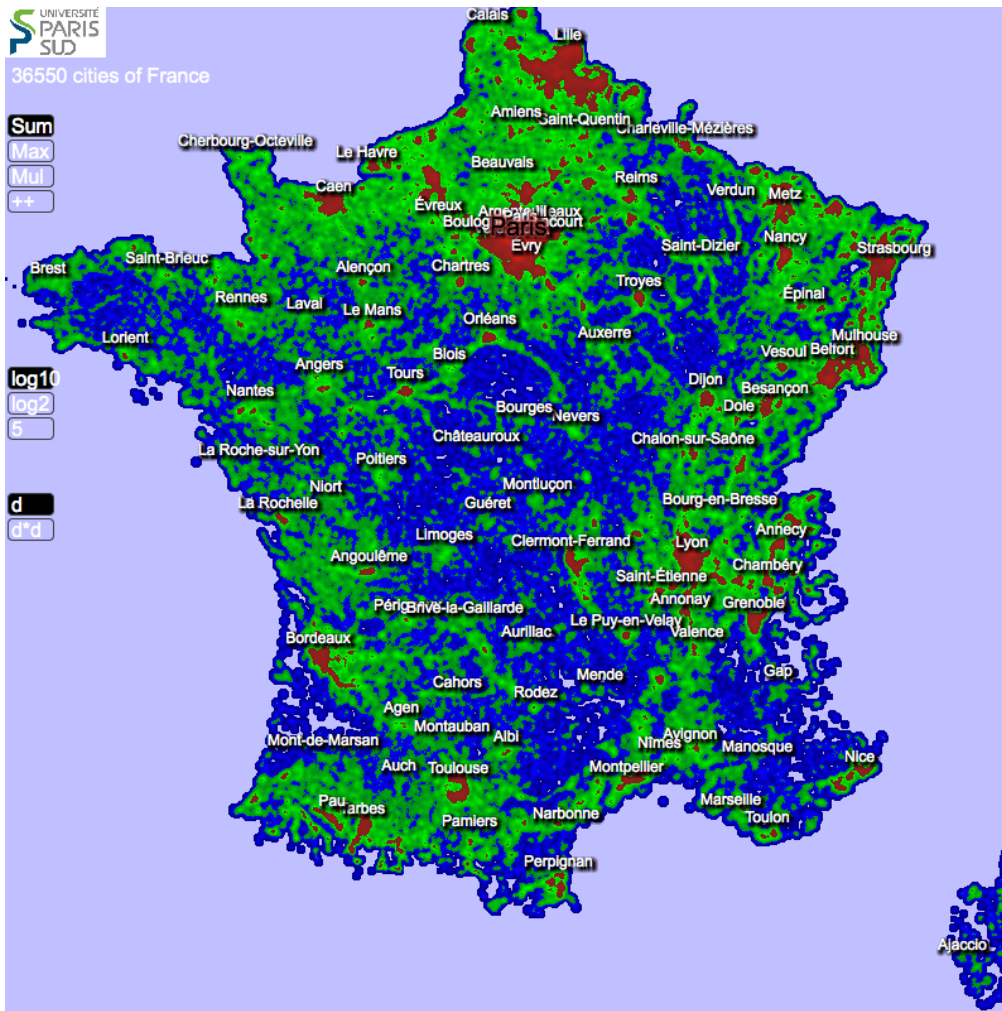


[color=random ... sorry]

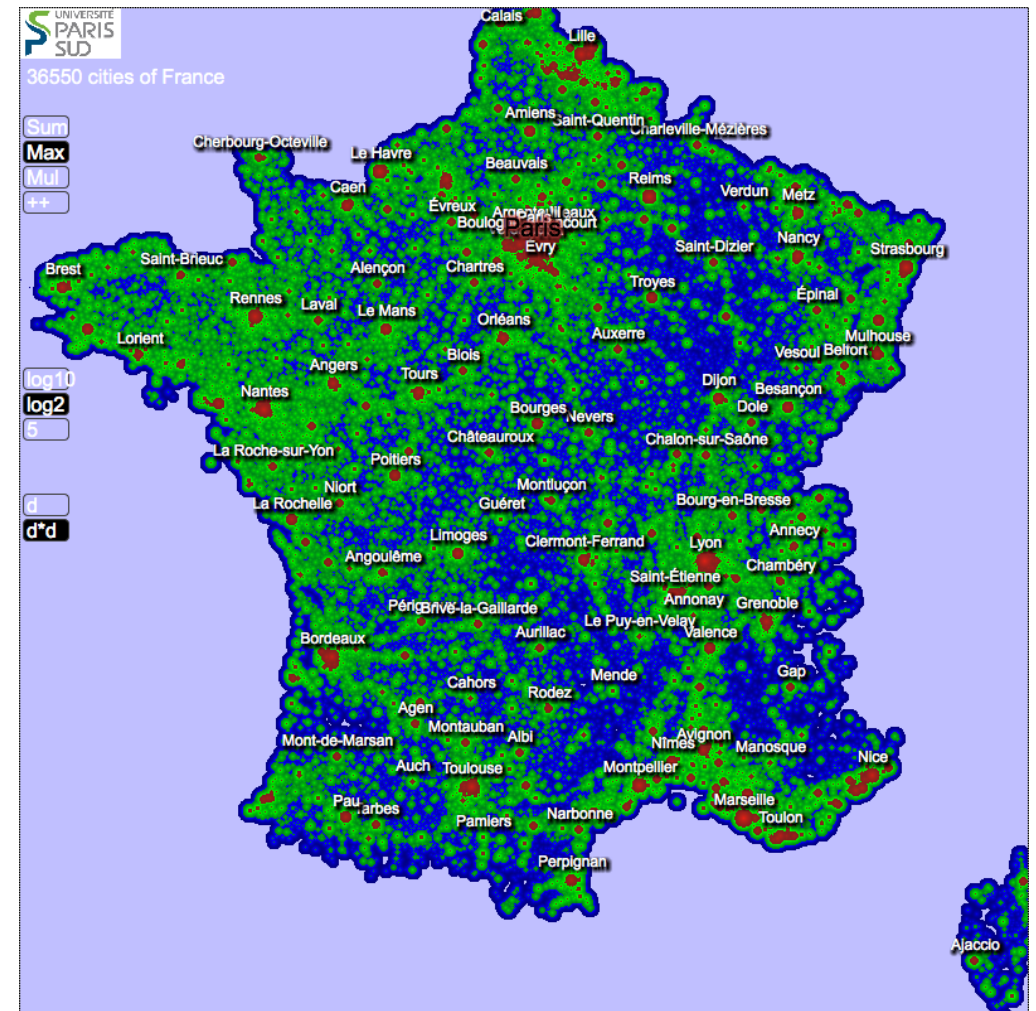


Heatmap generator 2/6

summing up population contribution



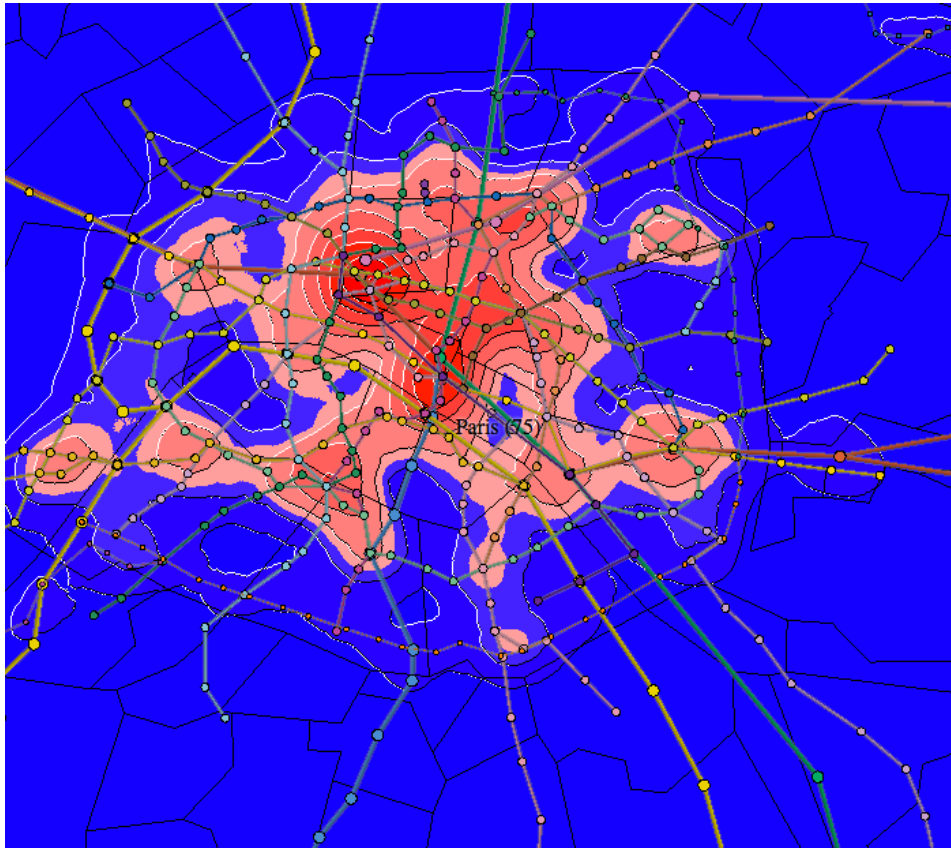
population density



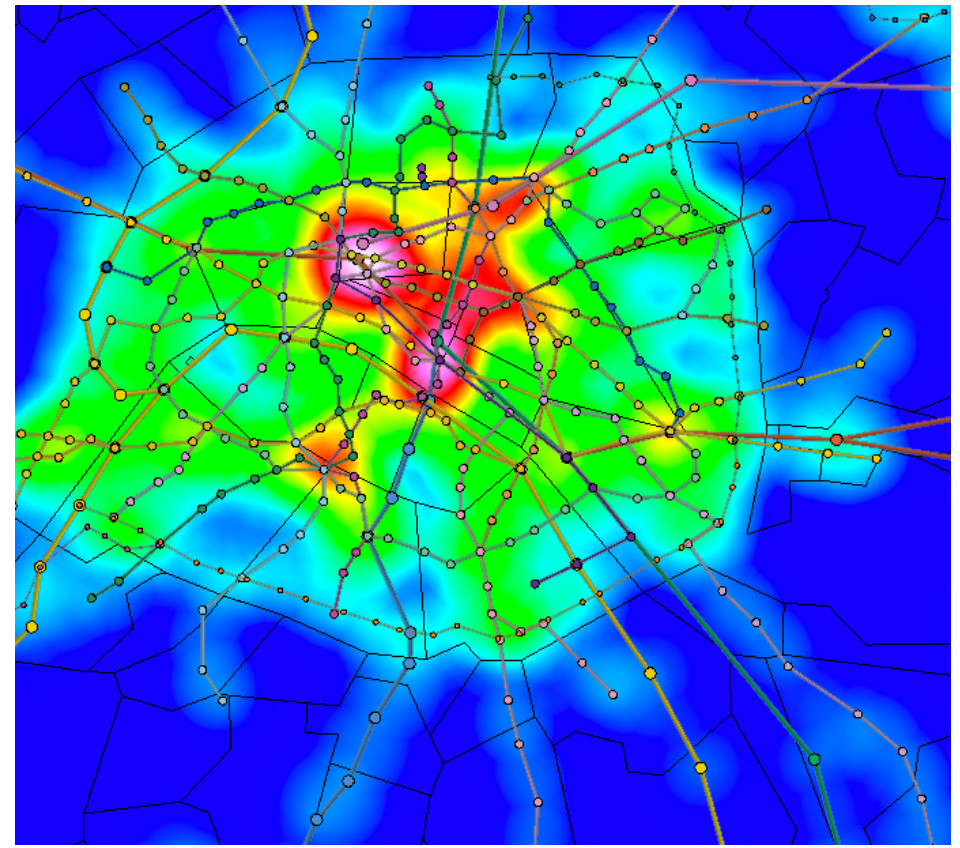
where the cities are

F. Vernier contribution 3/6

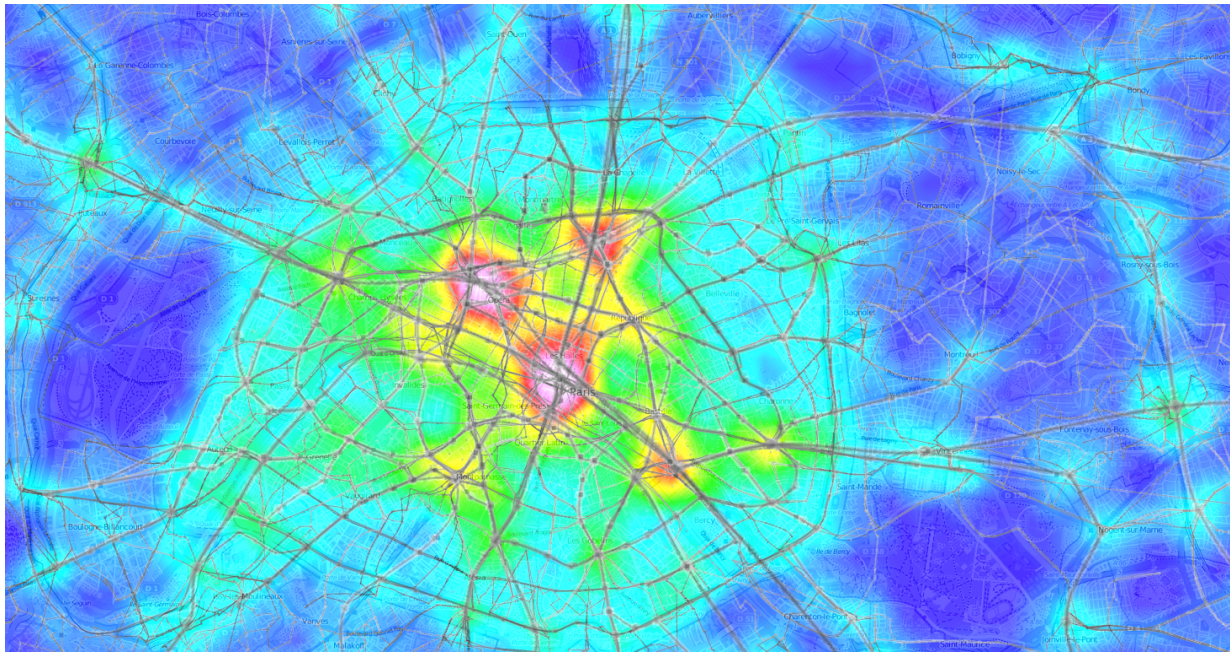
[Contour line]



[Heatmap]



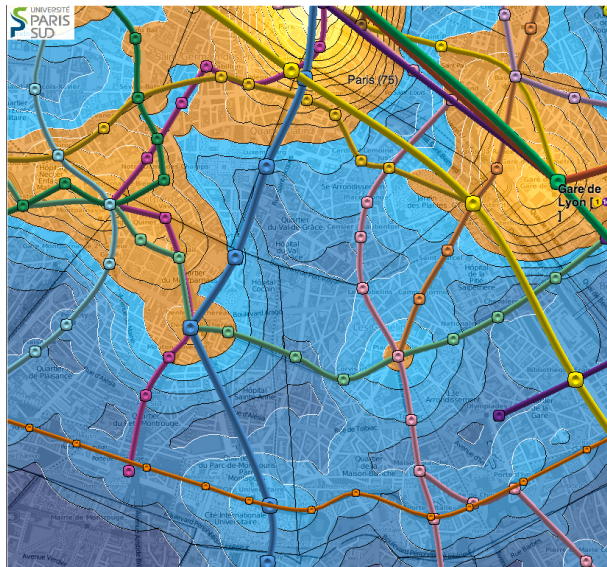
- Density of public transportation in Paris area



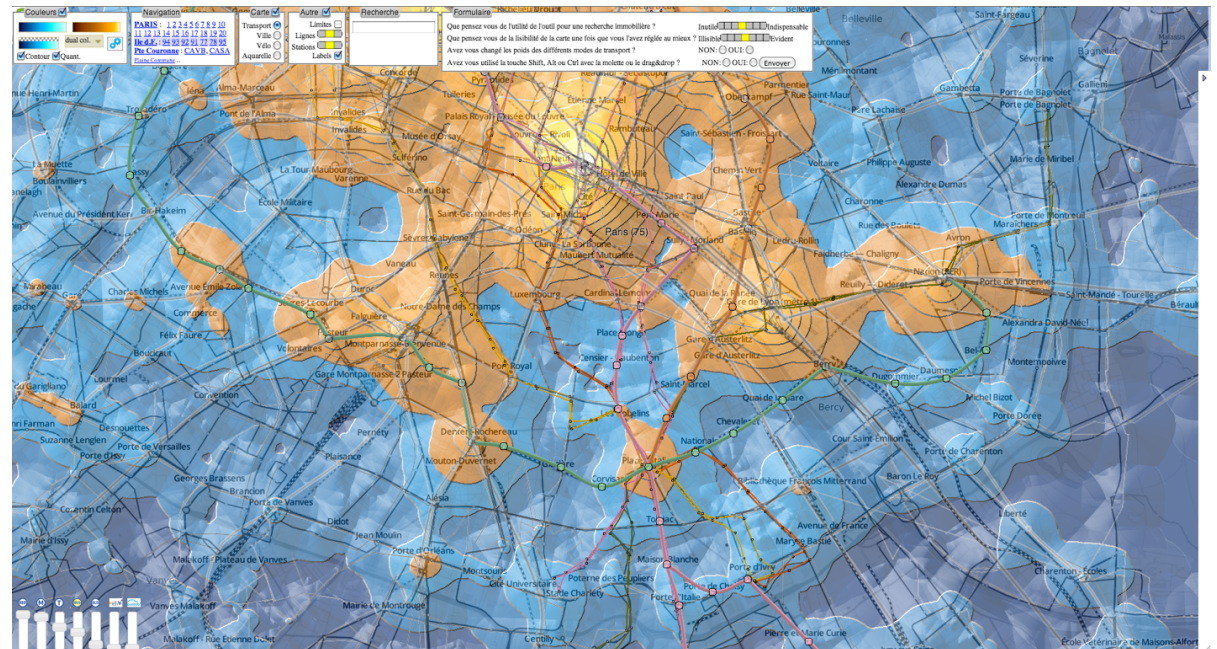
Heatmap + network

4/6

[Interactive Horizon Map]

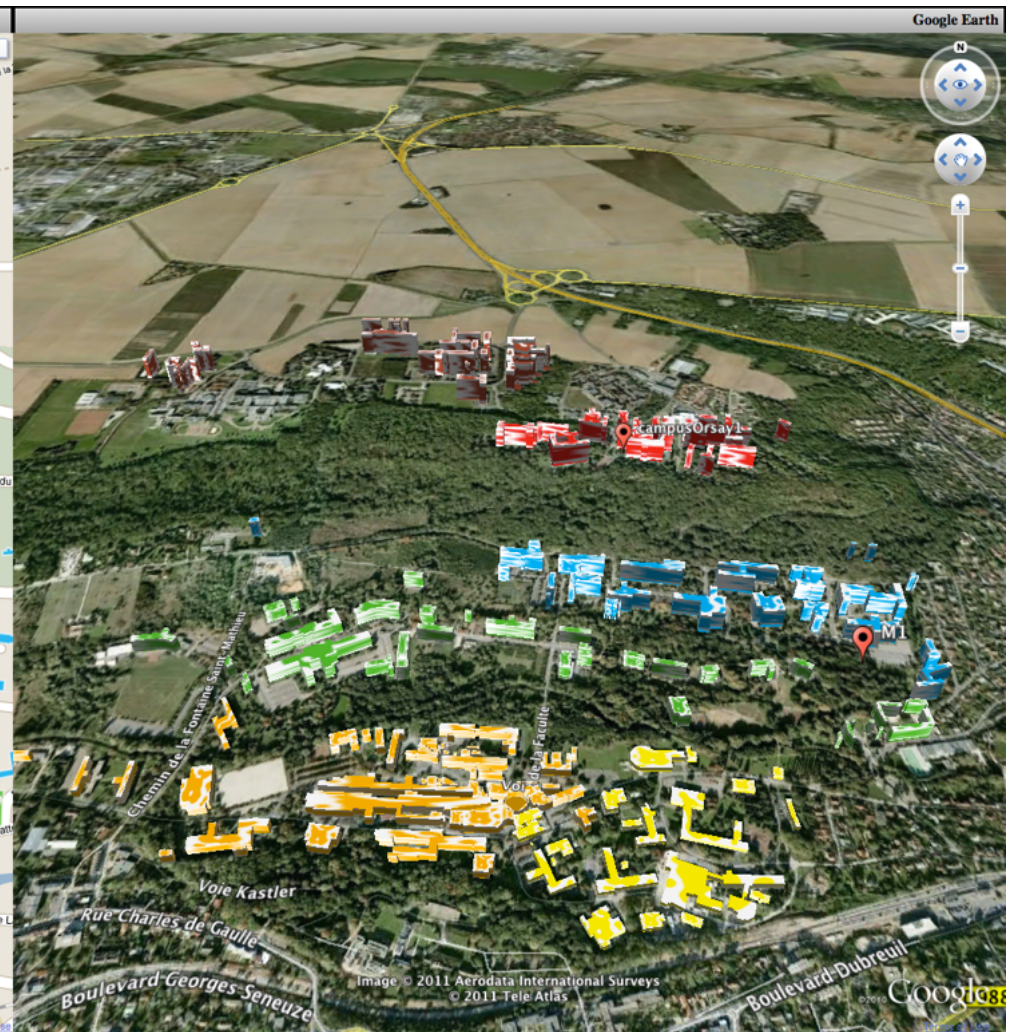


shading is too much !

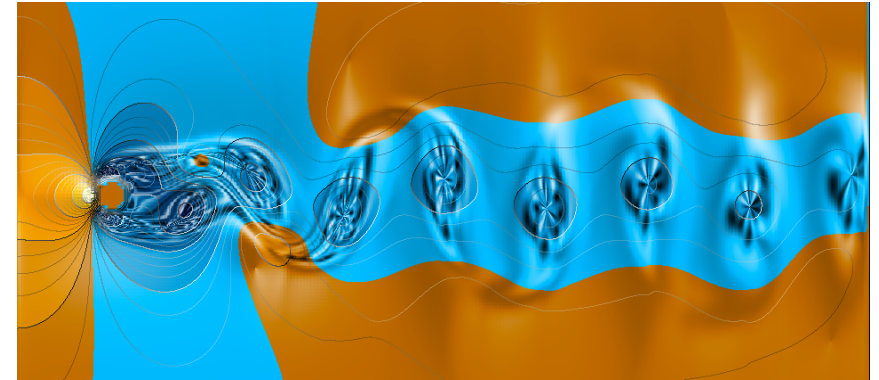
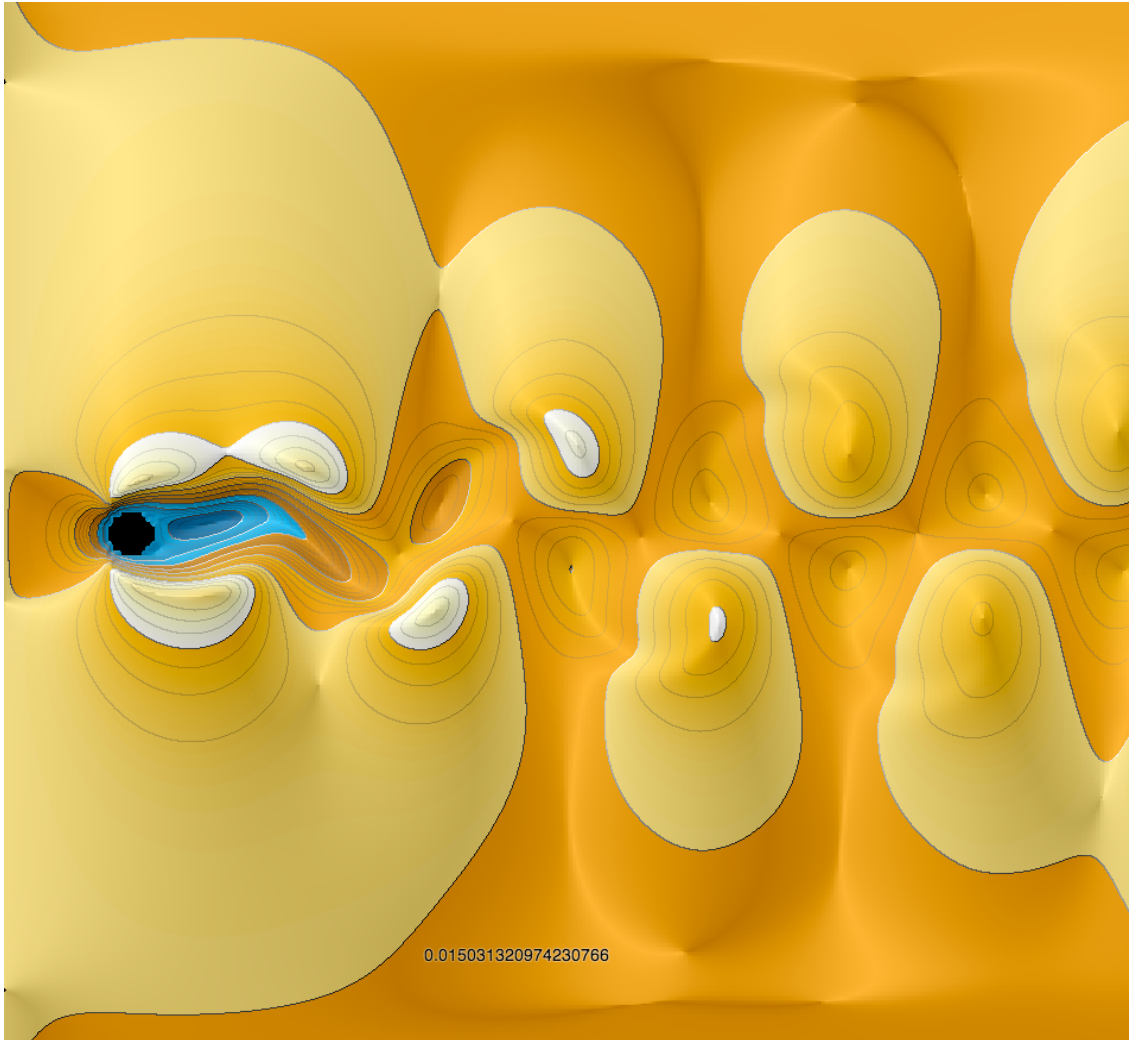


2D + 3D ? 5/6

...sorry



Von Koch channel



[+ vortices on velocity]

- contour lines
- double color-scale
INTERACTIVE LIMIT
- shading/saddle points
- granular vortices

[Pressure in Fluid mechanics simulation]

Conclusion

- Many alternatives
- Not only one map can fit all our needs
- Interactive computing reshuffle the cards
- 3D is NOT the future of maps
 - just a nice gadget

