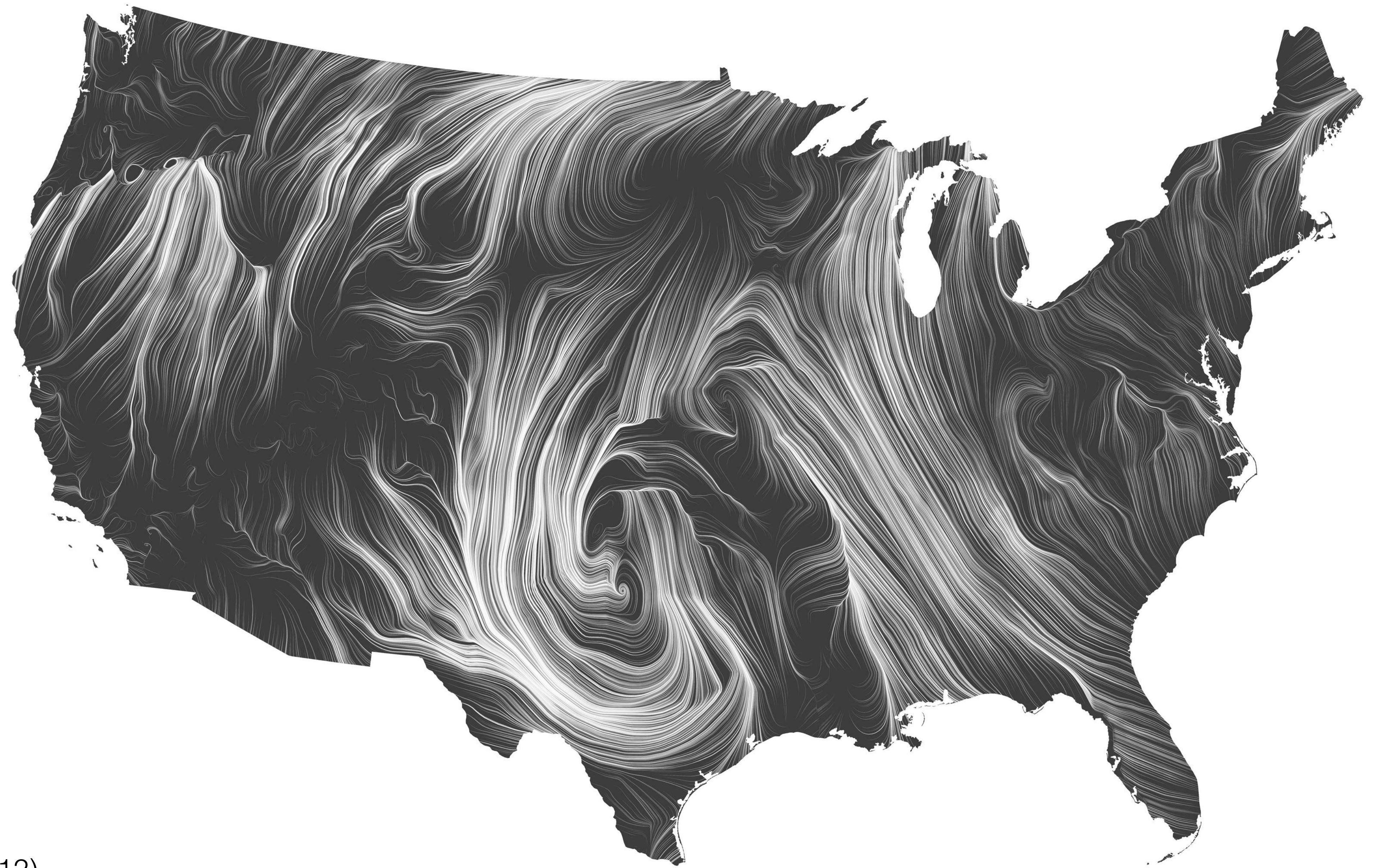


# INTRODUCTION TO MAPPING AND BASIC GIS CONCEPTS

MAPPING FOR ARCHITECTURE, URBANISM AND THE HUMANITIES - SPRING  
2016

# MAPPING



Wind Map (2012)

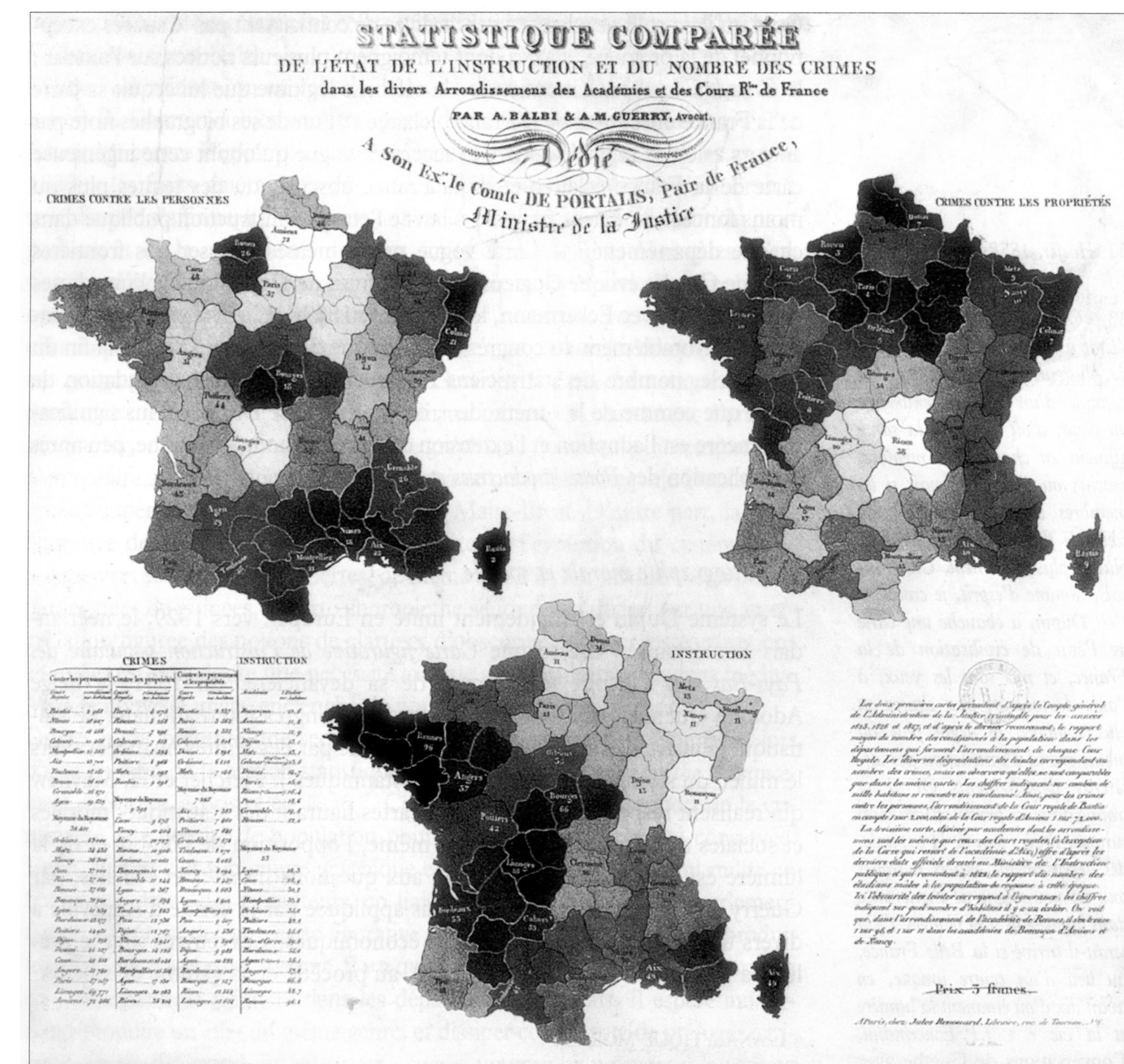
Fernanda Viegas and Martin Wattenberg

# THEMATIC MAPS

- “Thematic Maps” are representations of attribute data (quantitative and qualitative) on a base map.
- They display a “theme” (ie. social, political, economic, cultural) with the purpose of revealing patterns and frequencies in the geography where they occur.
- To “discover the geographical structure of the subject, impossible without mapping it, so as to relate the ‘geography’ of one distribution to that of others”.



A New and Correct Chart Showing the Variations  
of the Compass in the Western and Southern Oceans  
as Observed in the Year 1700  
Edmond Halley (1701)

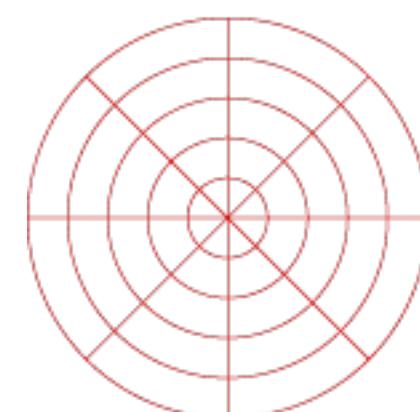
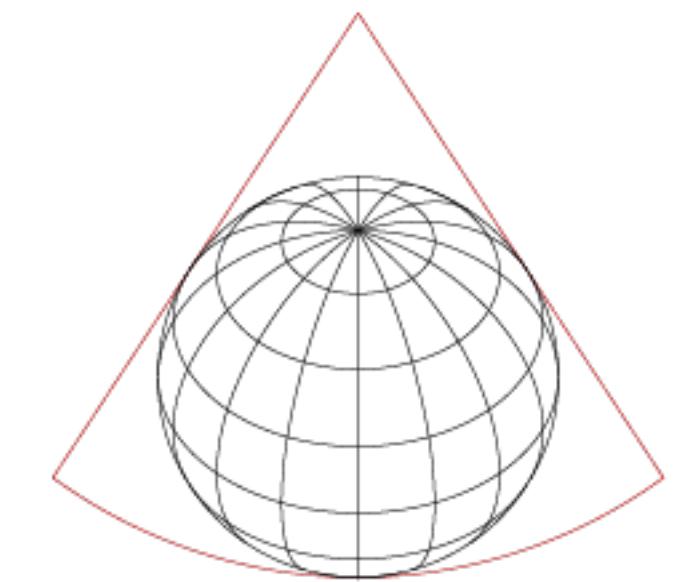
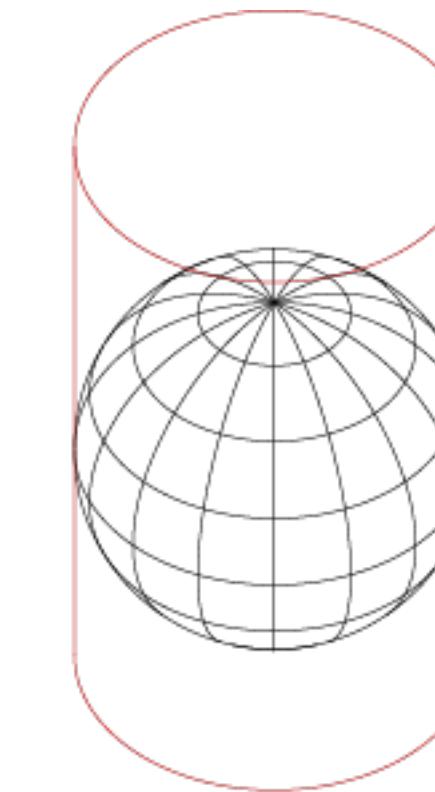
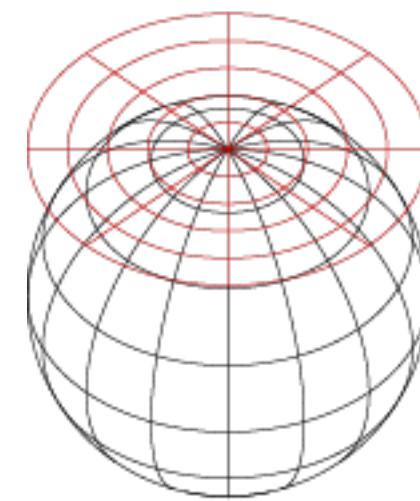


# THEMATIC MAPS

- “As data built up from environmental observations and measurements during the Enlightenment, attention shifted from place to space.”
- “Focus shifted from analytical concern with the position of features to holistic concern with the spatial extent and variation of features.”
- “Thus, the idea of distribution was born. The conceptual leap from place to space...”

# MAP PROJECTIONS

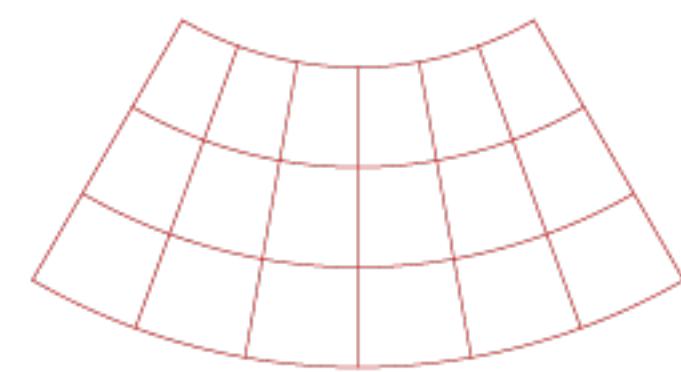
- Projections are mathematical transformations of the curved three-dimensional surface of the globe onto a flat, two-dimensional plane.
- They involve transformations that result in distortions of one or more of the geometric properties of angles, areas, shapes, distances, and directions.



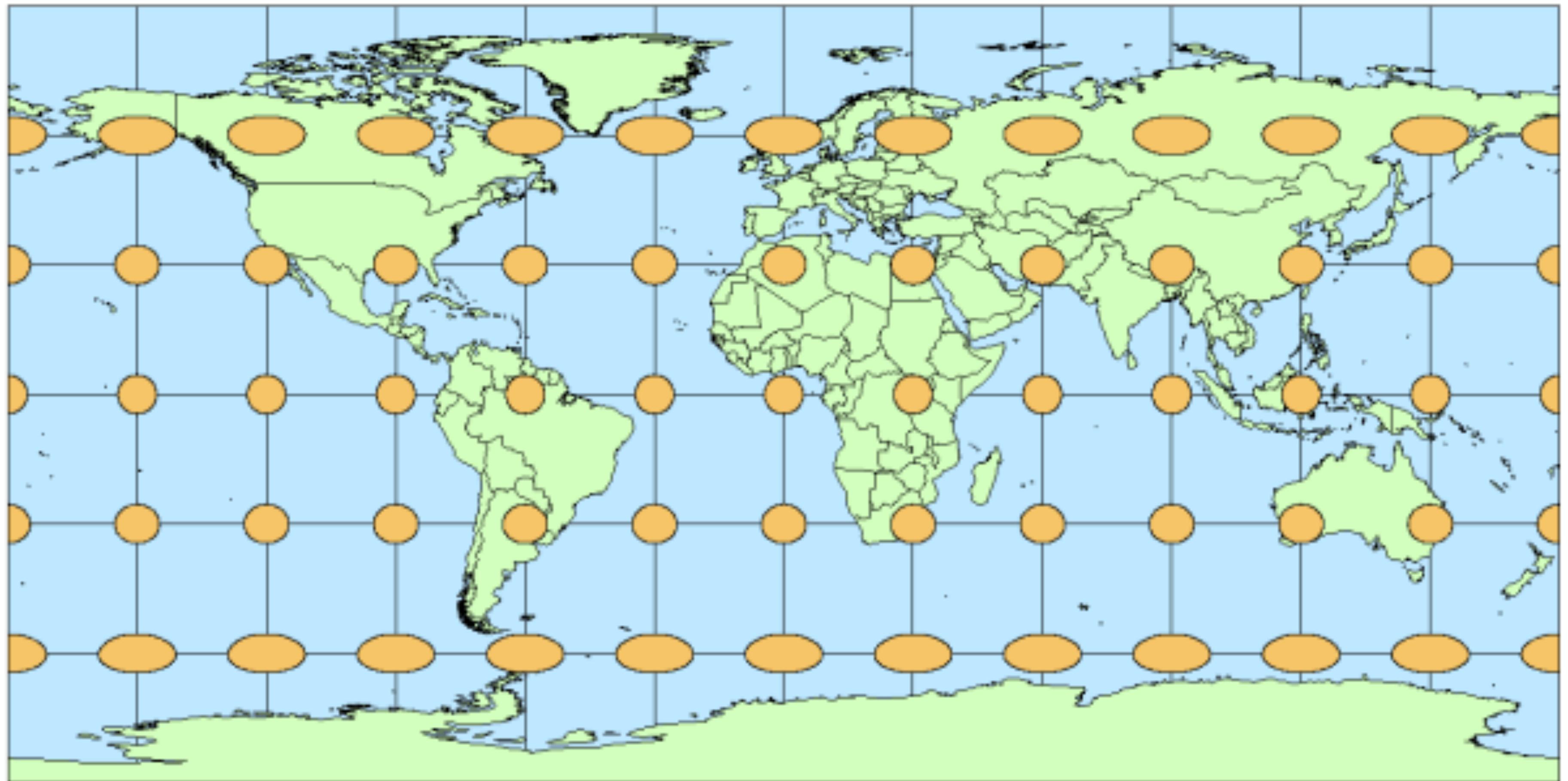
Plane/Azimuthal



Cylinder/Cylindrical

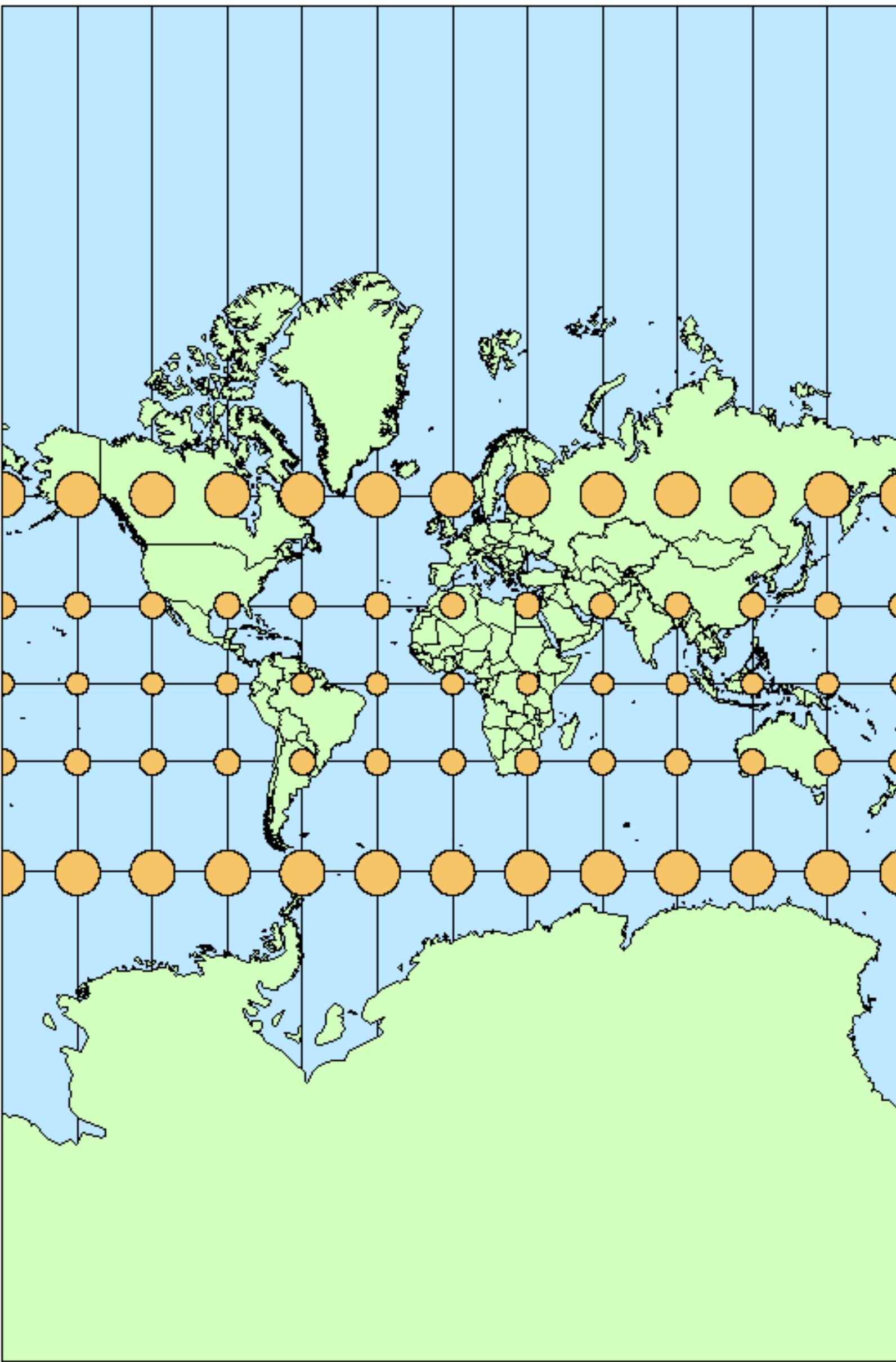


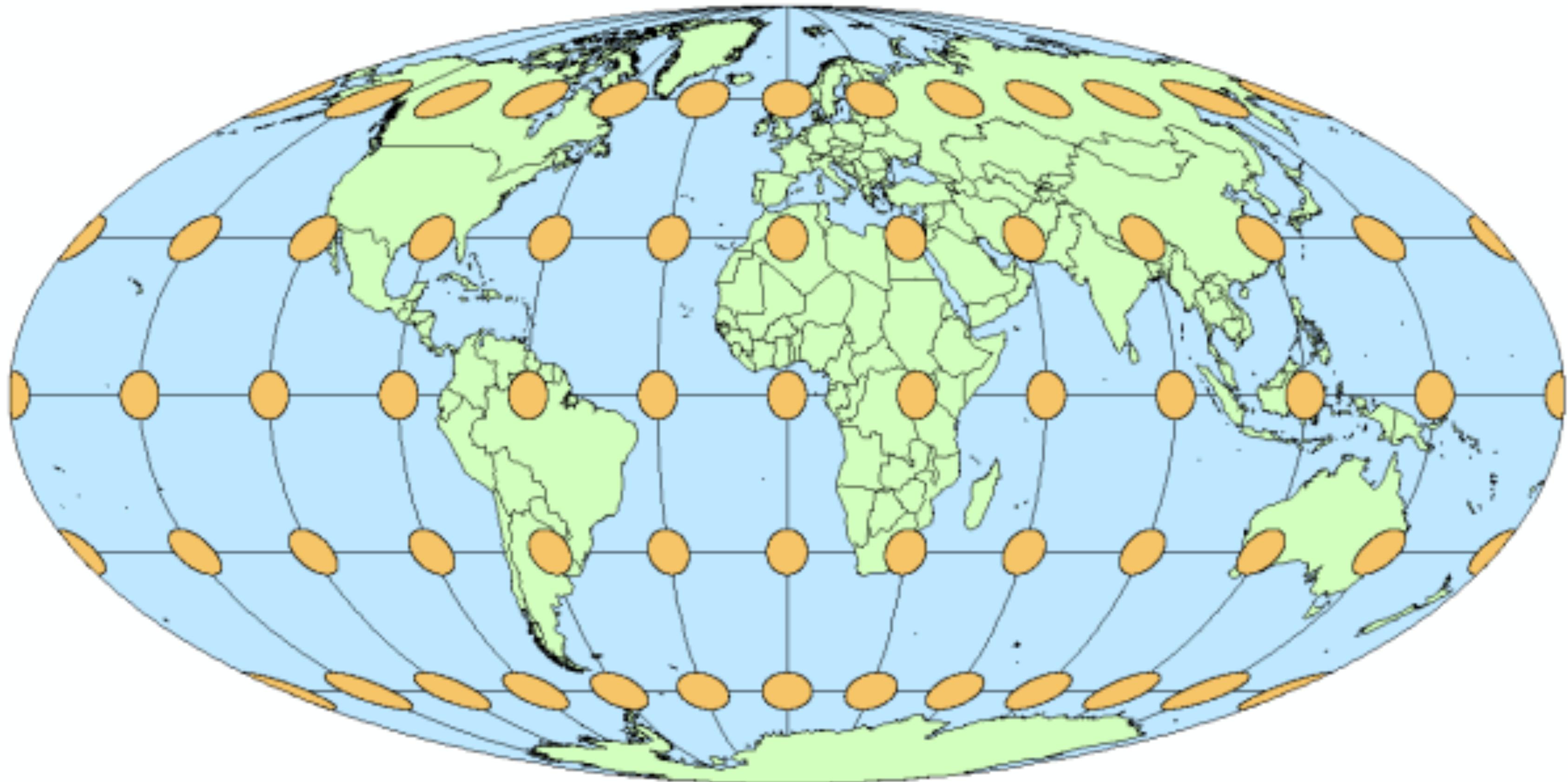
Cone/Conic



Tissot Indicatrix  
WGS84 geographic (Plate Carré) projection

Tissot Indicatrix  
Mercator projection  
“Conformal”: Areas and shapes vary  
with latitude, specially away from the  
Equator. All indicatrices are circles.  
There are no angular distortions.

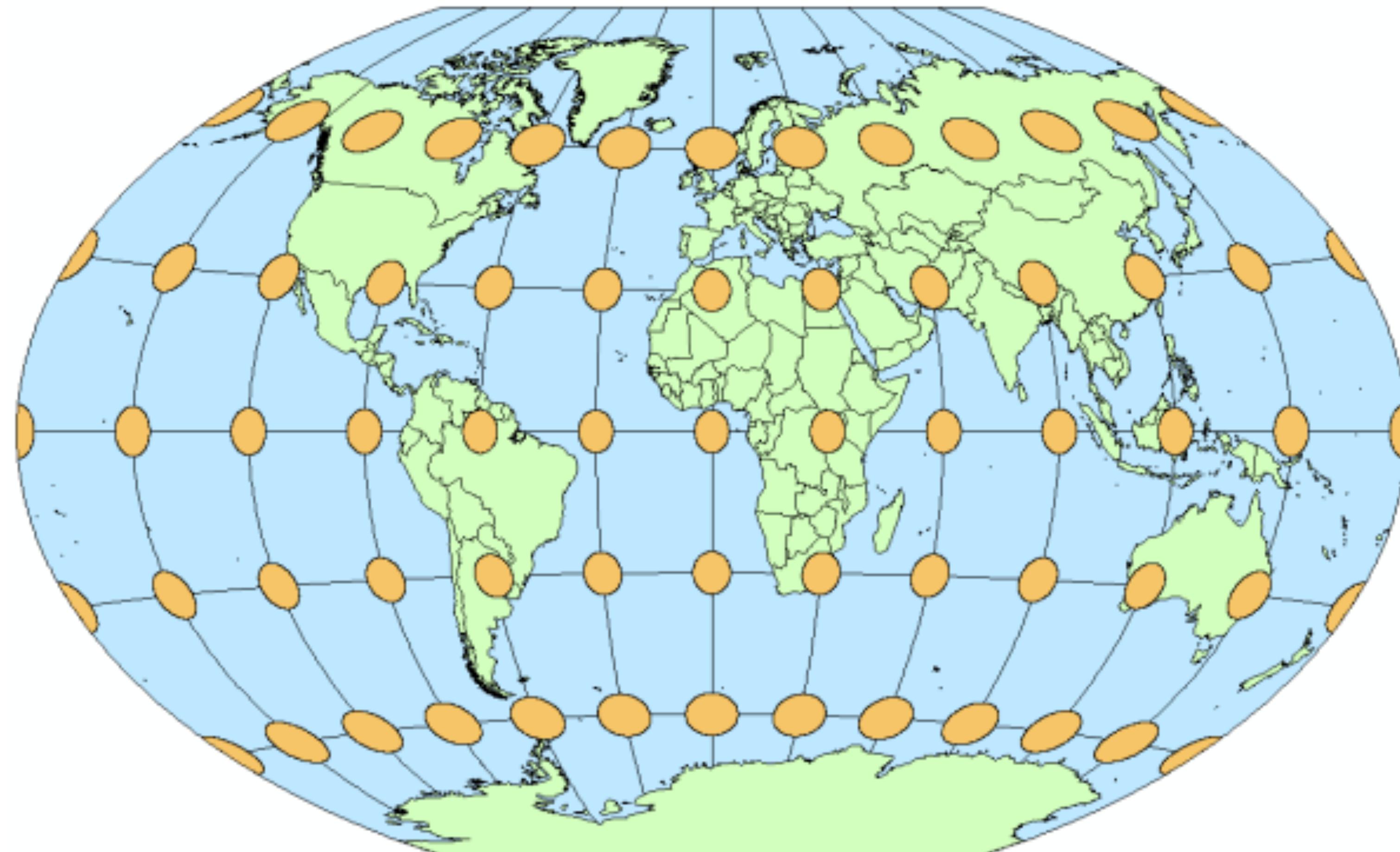




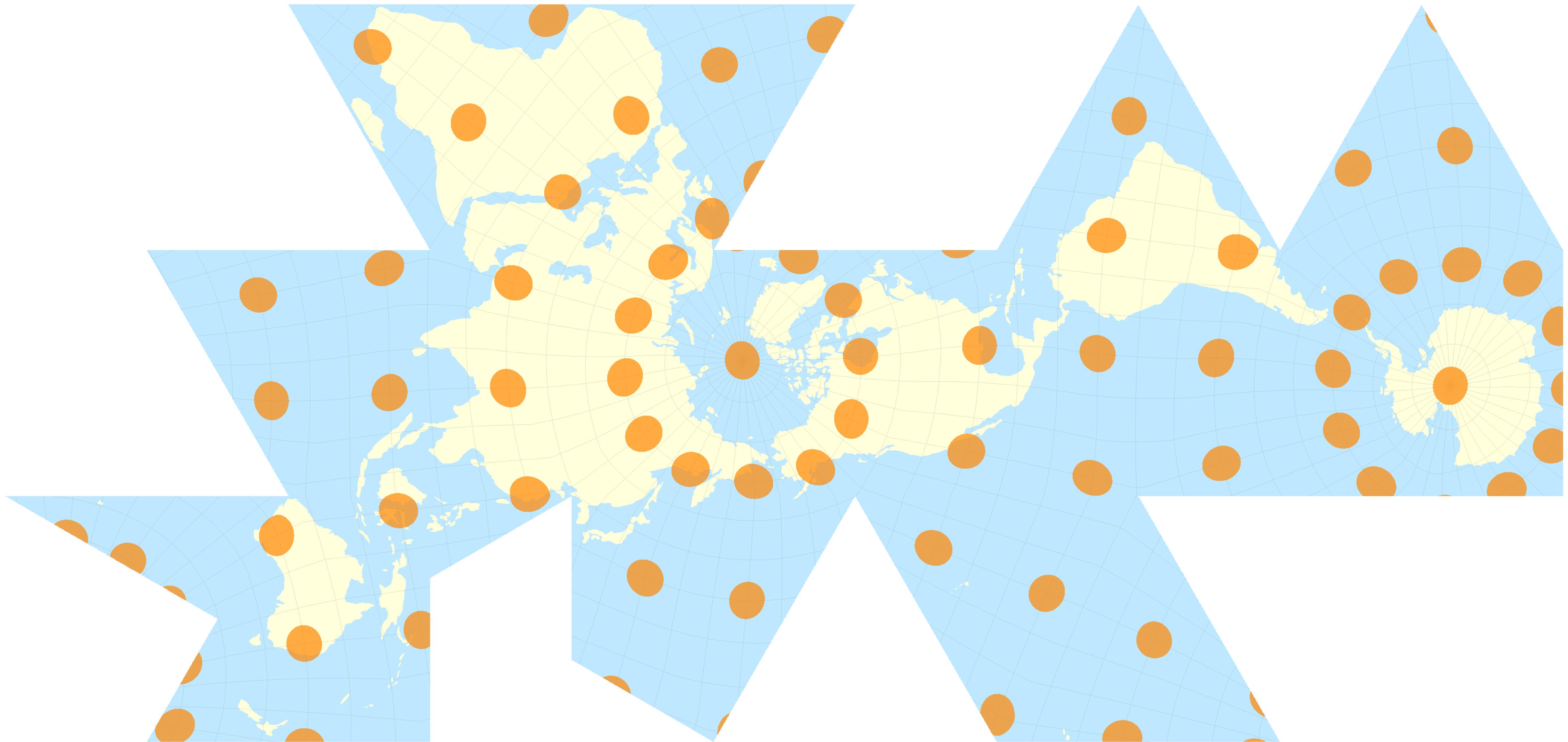
Tissot Indicatrix

Mollewide projection

“Equal Area”: The relative size  
of the indicatrices is preserved, but  
the ellipses are distorted in shape  
and orientation.



Tissot Indicatrix  
Winkel Tripel projection  
“Compromise”: The indicatrices  
vary in size, shape and orientation.



Tissot Indicatrix

Fuller projection (Dymaxion Map)

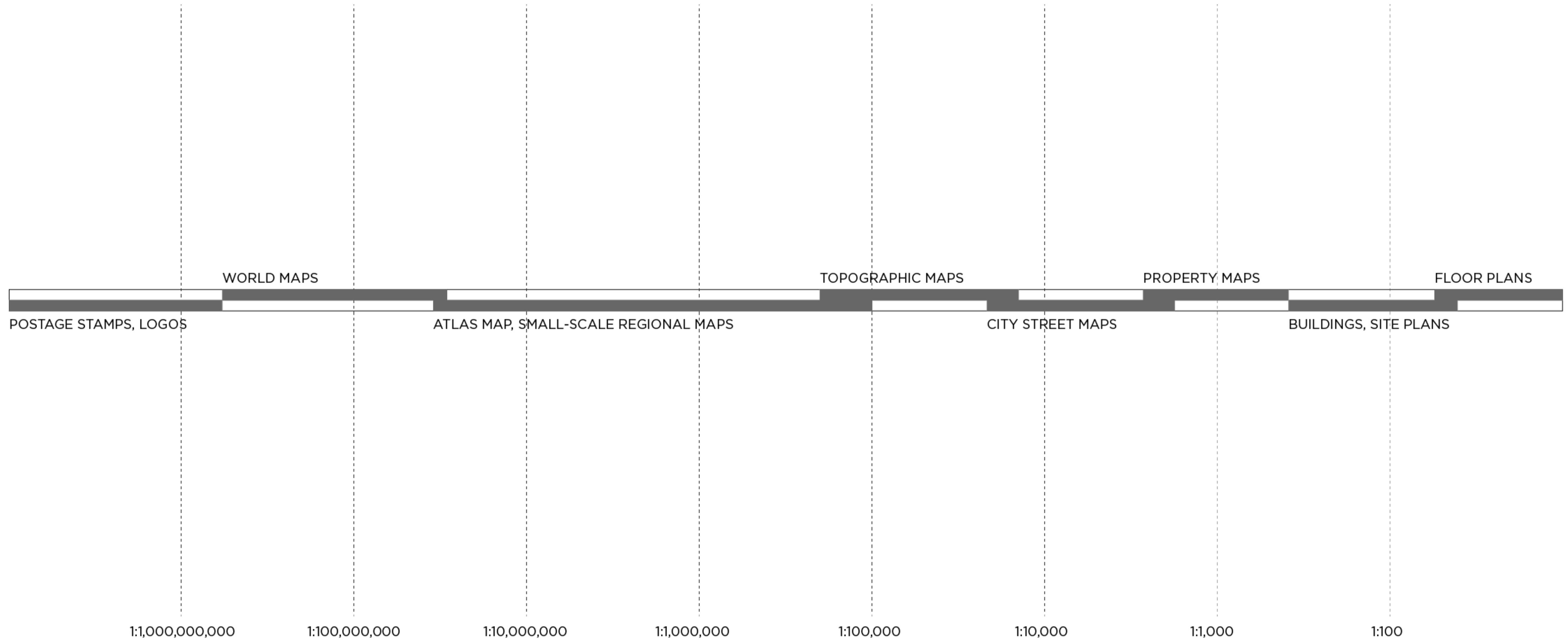
“Compromise”: The indicatrices vary in size, shape and orientation.

But, the variation is less than in other projections, and it doesn’t have a “right” way.

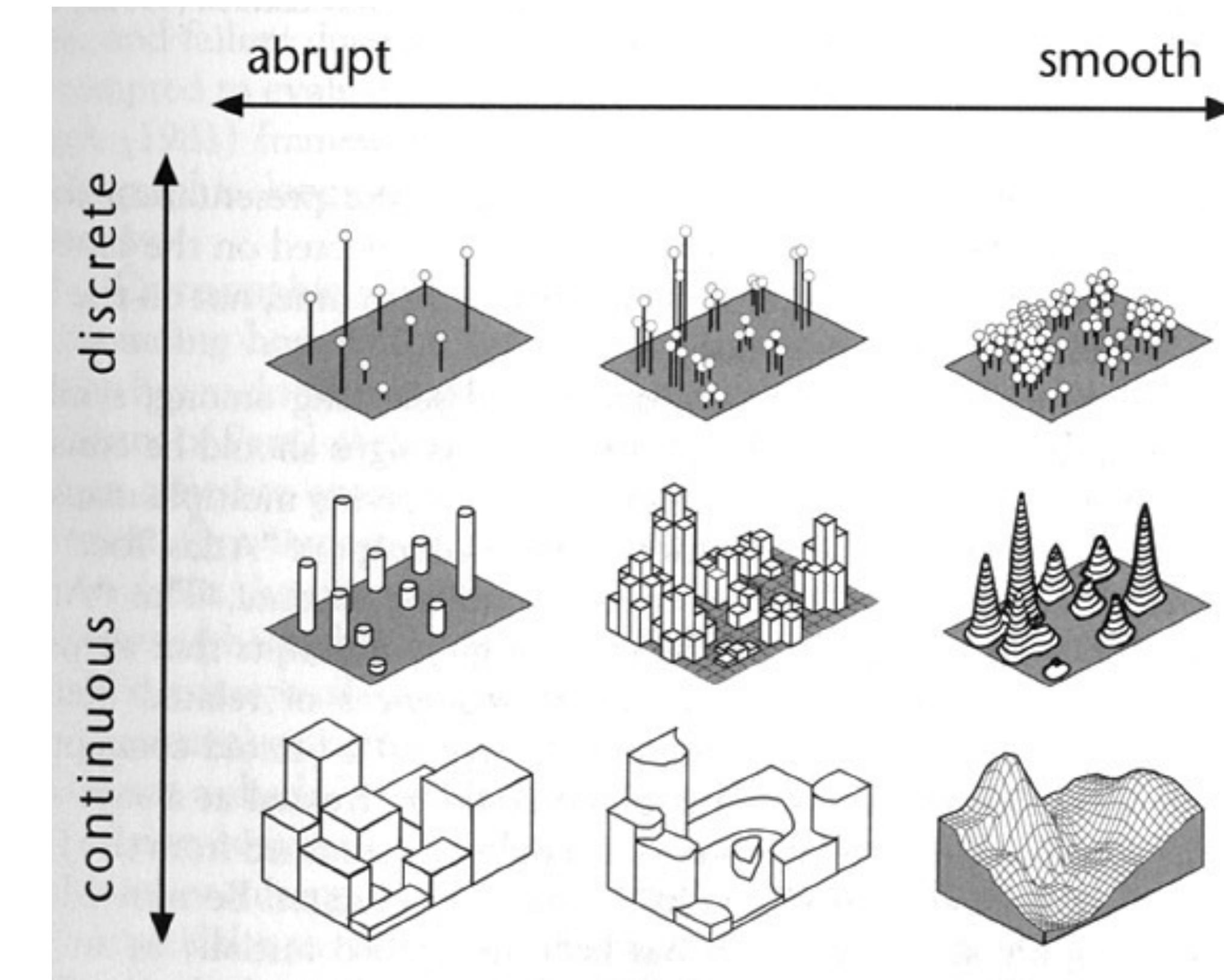
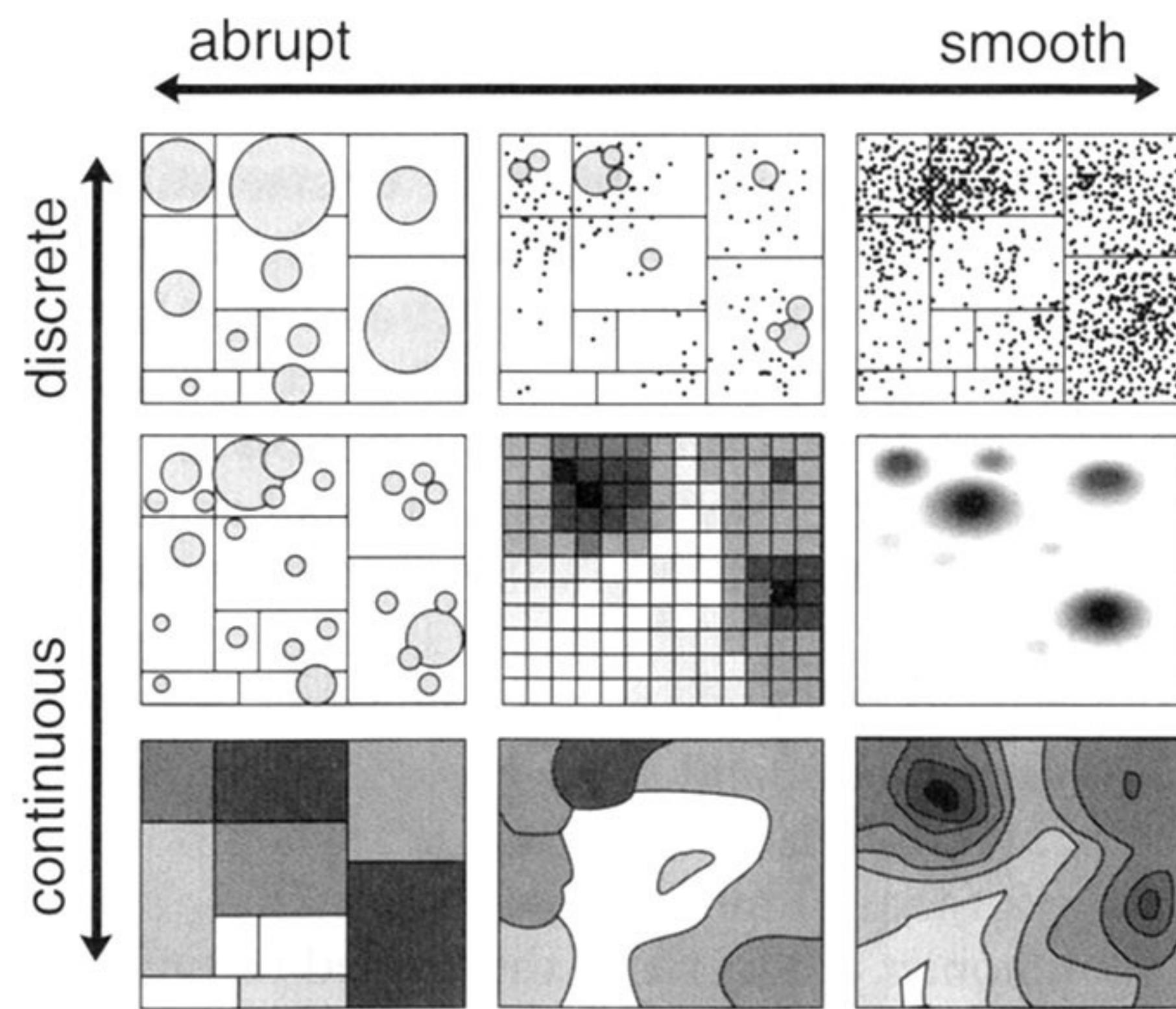
# Recentering: Volcanic activity around the world Traugott Bromme (1851)



# SCALES

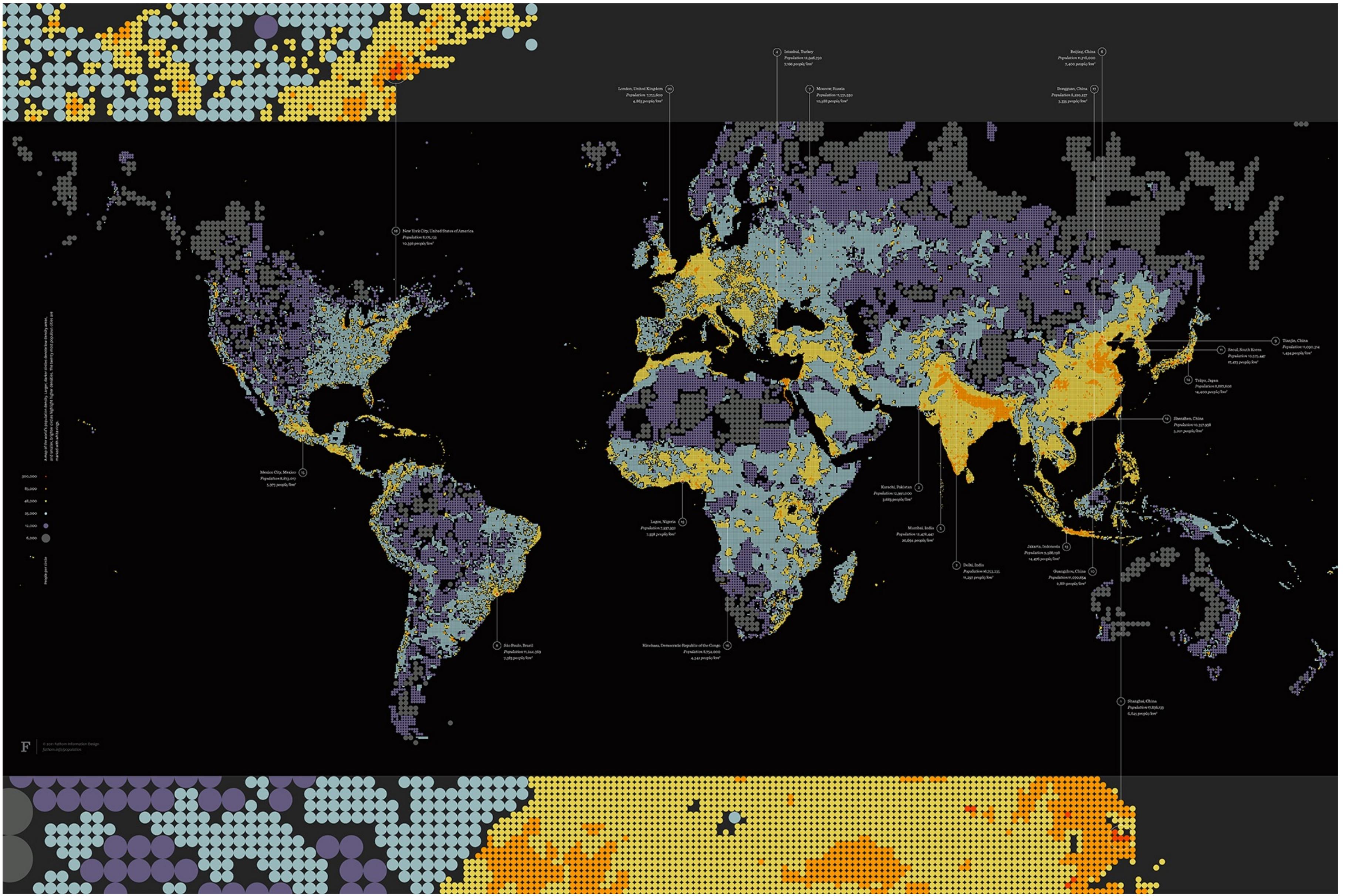


# DATA TYPES



# GRAPHICAL METHODS

- Dot distribution maps
- Graduated symbol maps
- Isometric and isopleth maps
- Flow and network maps
- Area and distance cartograms

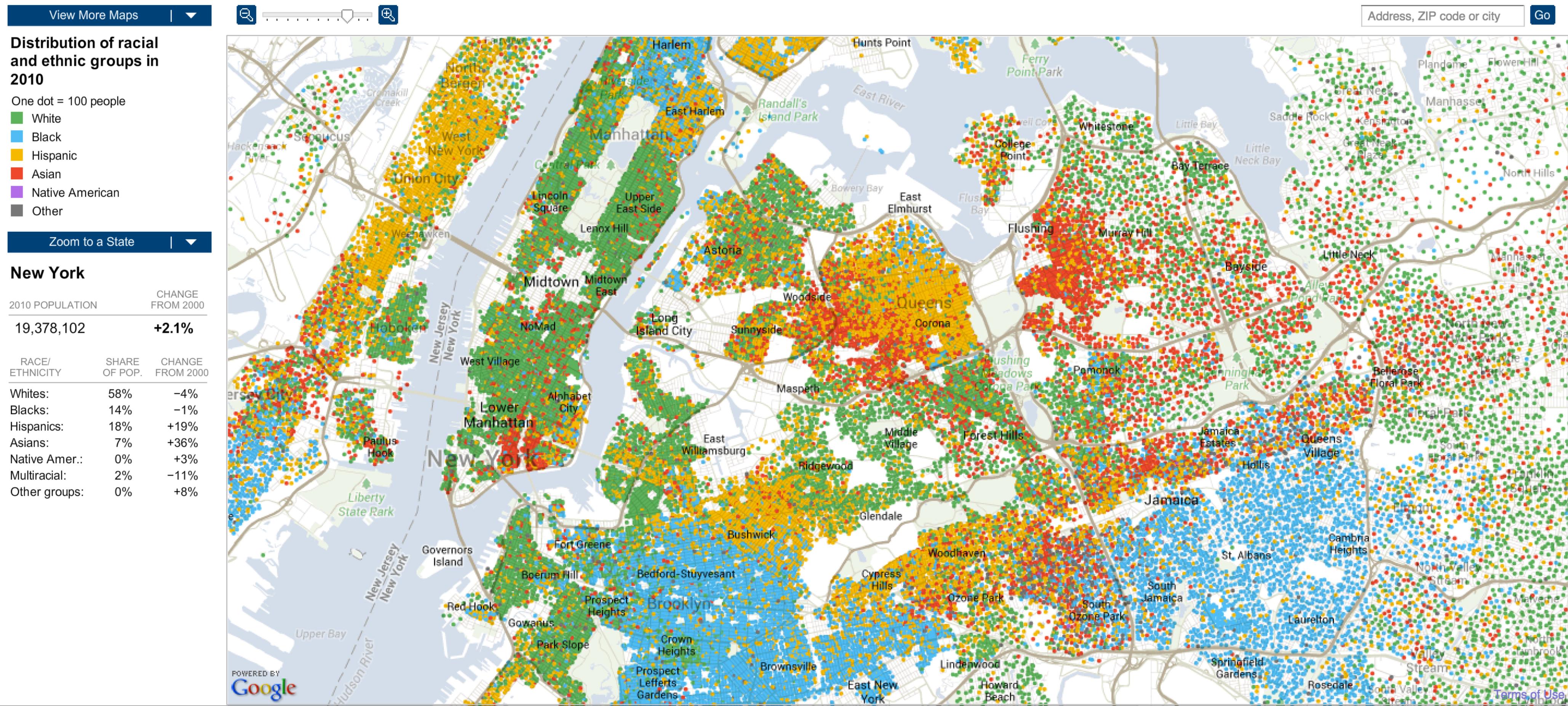


Dot distribution map

# Mapping the 2010 U.S. Census

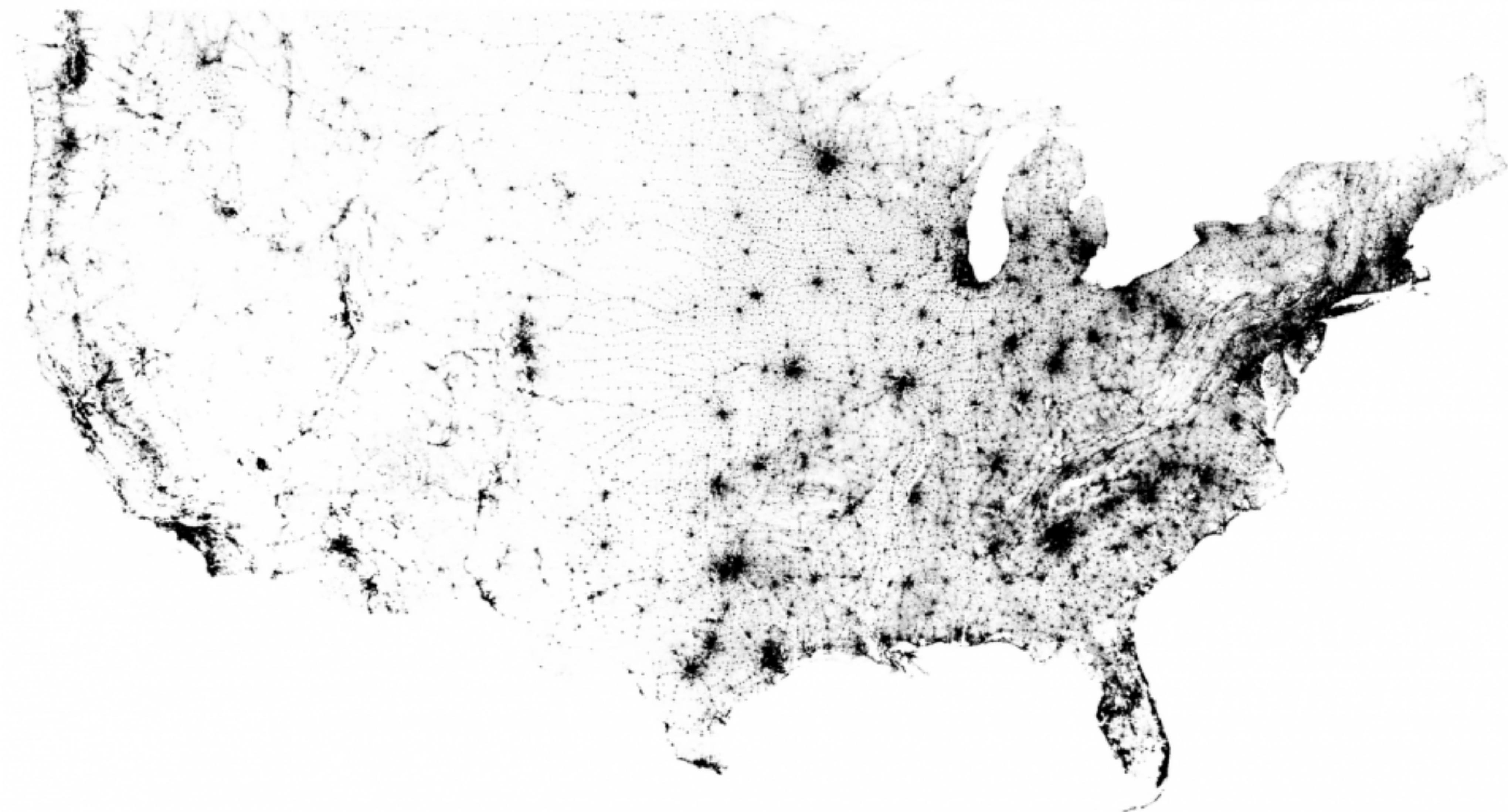
Share this view on [Twitter](#) or [Facebook](#)

Browse population growth and decline, changes in racial and ethnic concentrations and patterns of housing development.

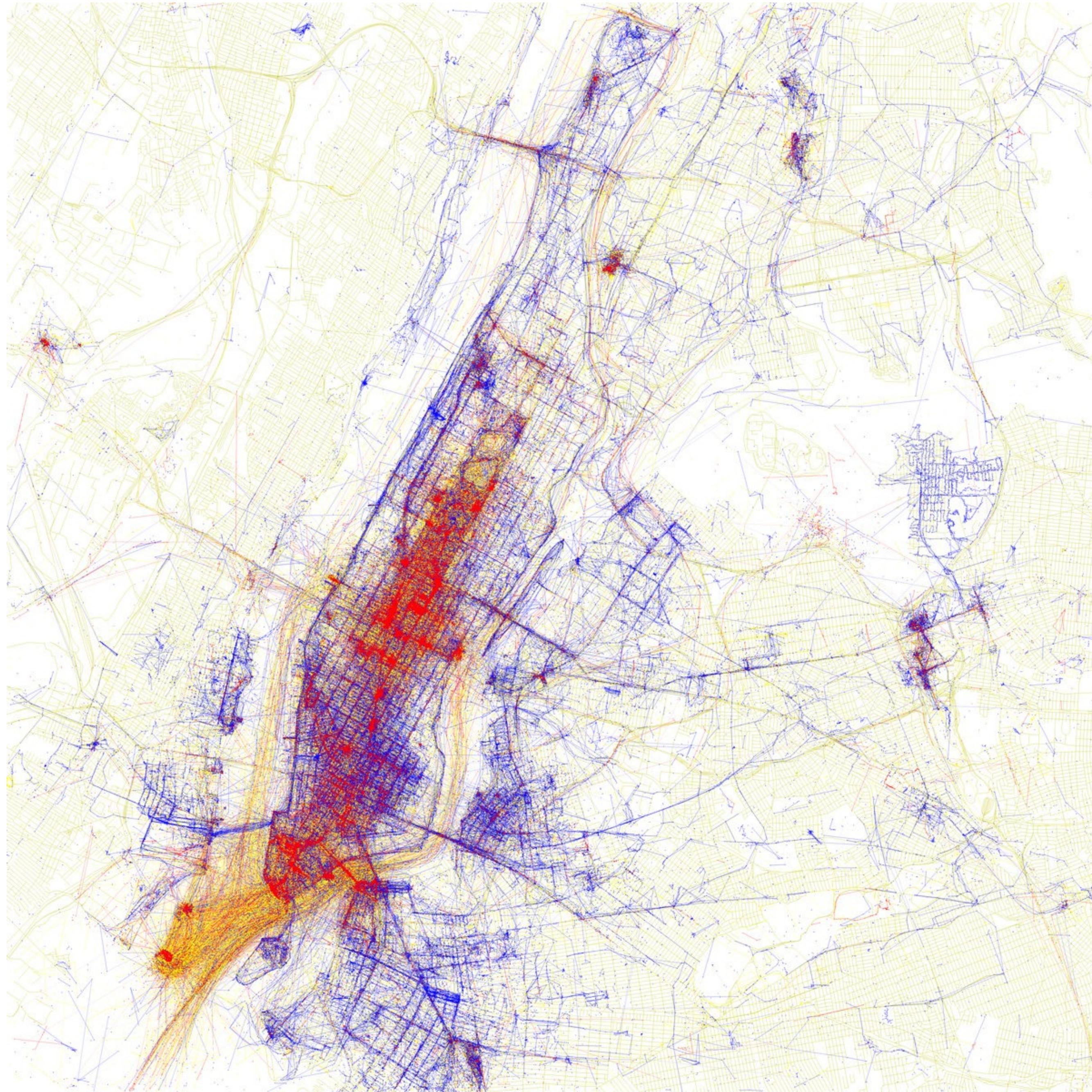


By MATTHEW BLOCH, SHAN CARTER and ALAN McLEAN | Source: [Census Bureau](#); [socialexplorer.com](#)

Dot distribution map

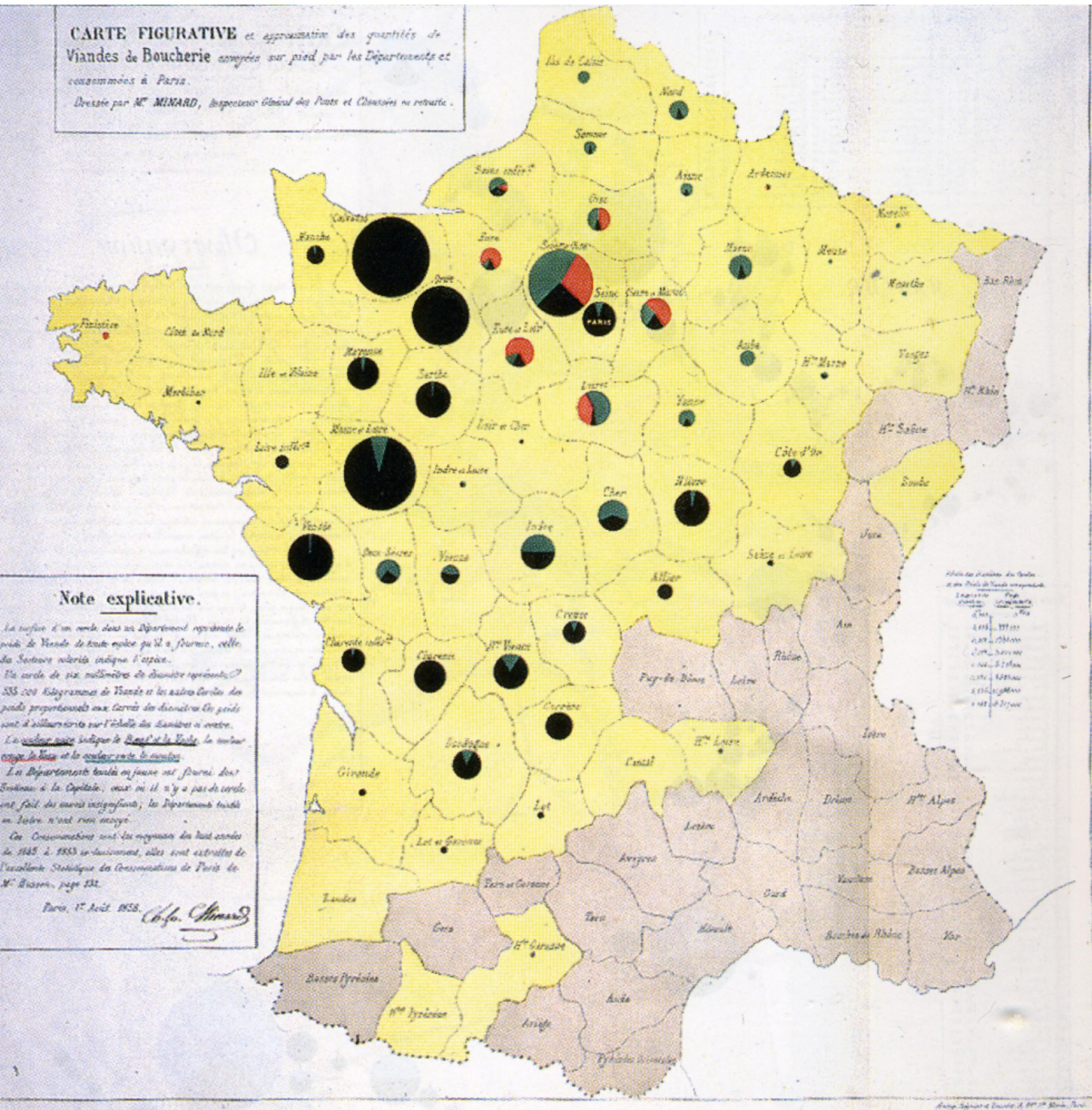


Dot distribution map



Dot distribution map

CARTE FIGURATIVE et approximative des quantités de  
Viandes de Boucherie consommées sur pied par les Départements et  
consommées à Paris.  
Dressée par M<sup>e</sup> MINARD, inspecteur général des Ponts et Chaussées en retraite.



Graduated symbol

**365**  **Obama**  
Electoral Votes  
Projected Winner

**0**  
undecided

**173** **McCain**  
Electoral Votes

Popular vote: 66,862,039

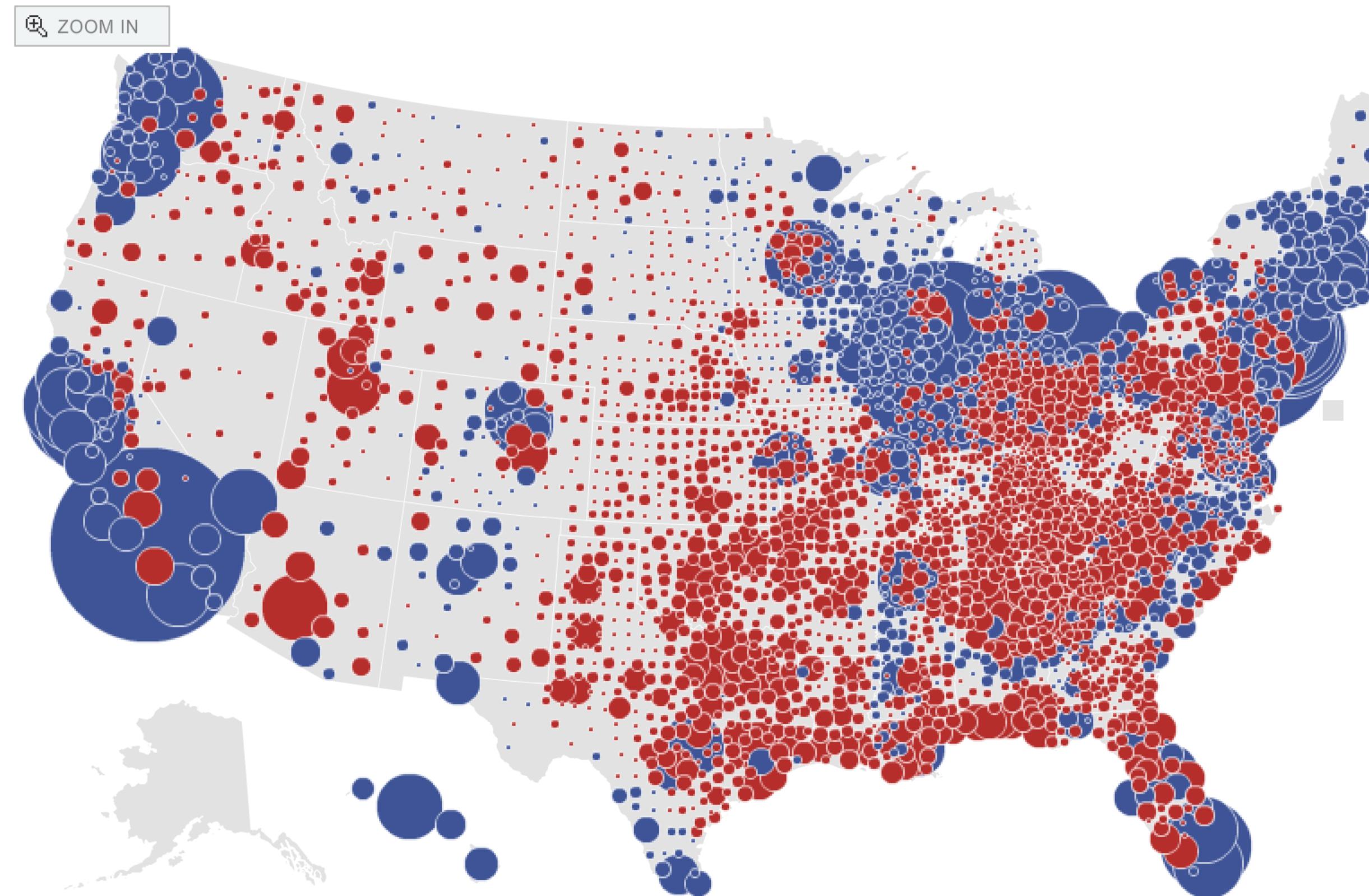
270 needed to win

Popular vote: 58,319,442

State winners  
County bubbles  
County leaders  
Voting shifts

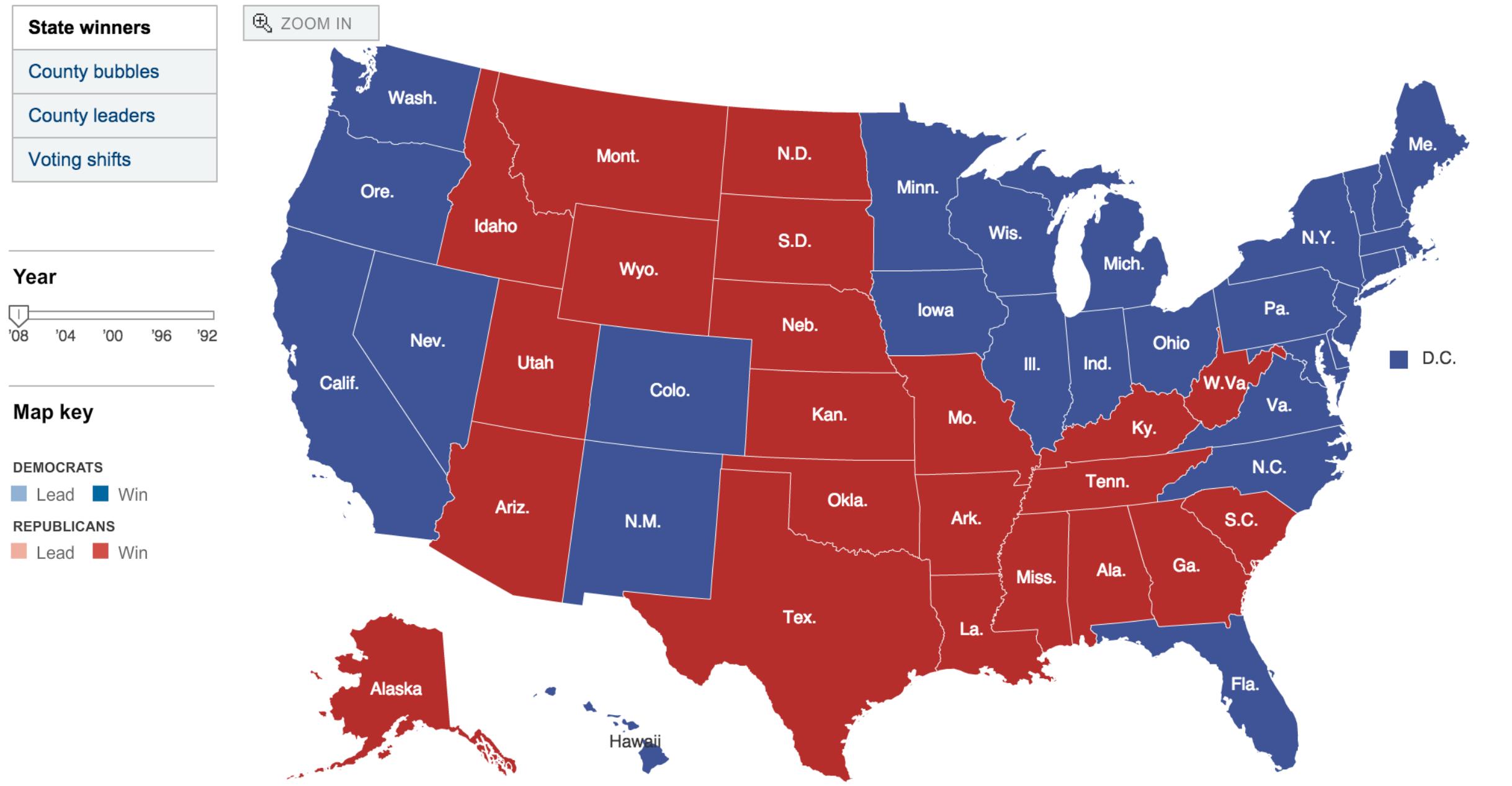
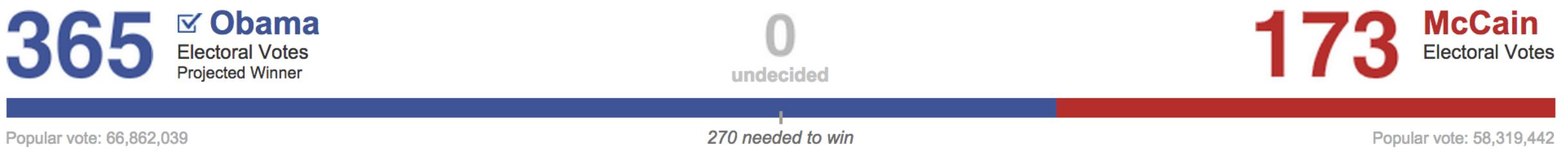
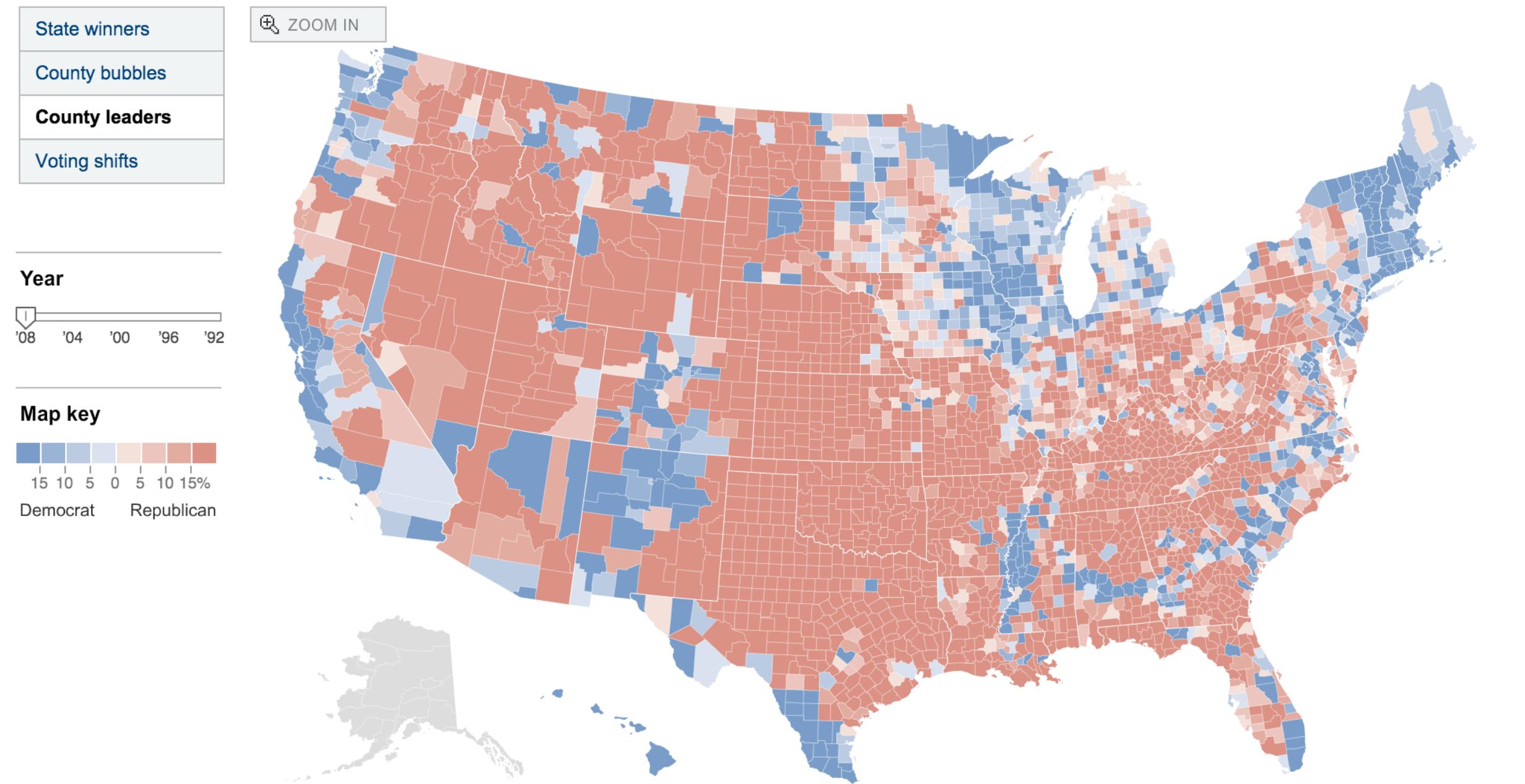
Year  
 '08 '04 '00 '96 '92

Map key  
Circle size is proportional to  
the amount each county's  
leading candidate is ahead.  
  
Larger      Smaller



Graduated symbol

\* One electoral vote in Nebraska remains undecided. The state allocates its electoral votes on the basis of the results in each Congressional district. Only 569 votes separate John McCain and Barack Obama in unofficial returns from the 2nd District.



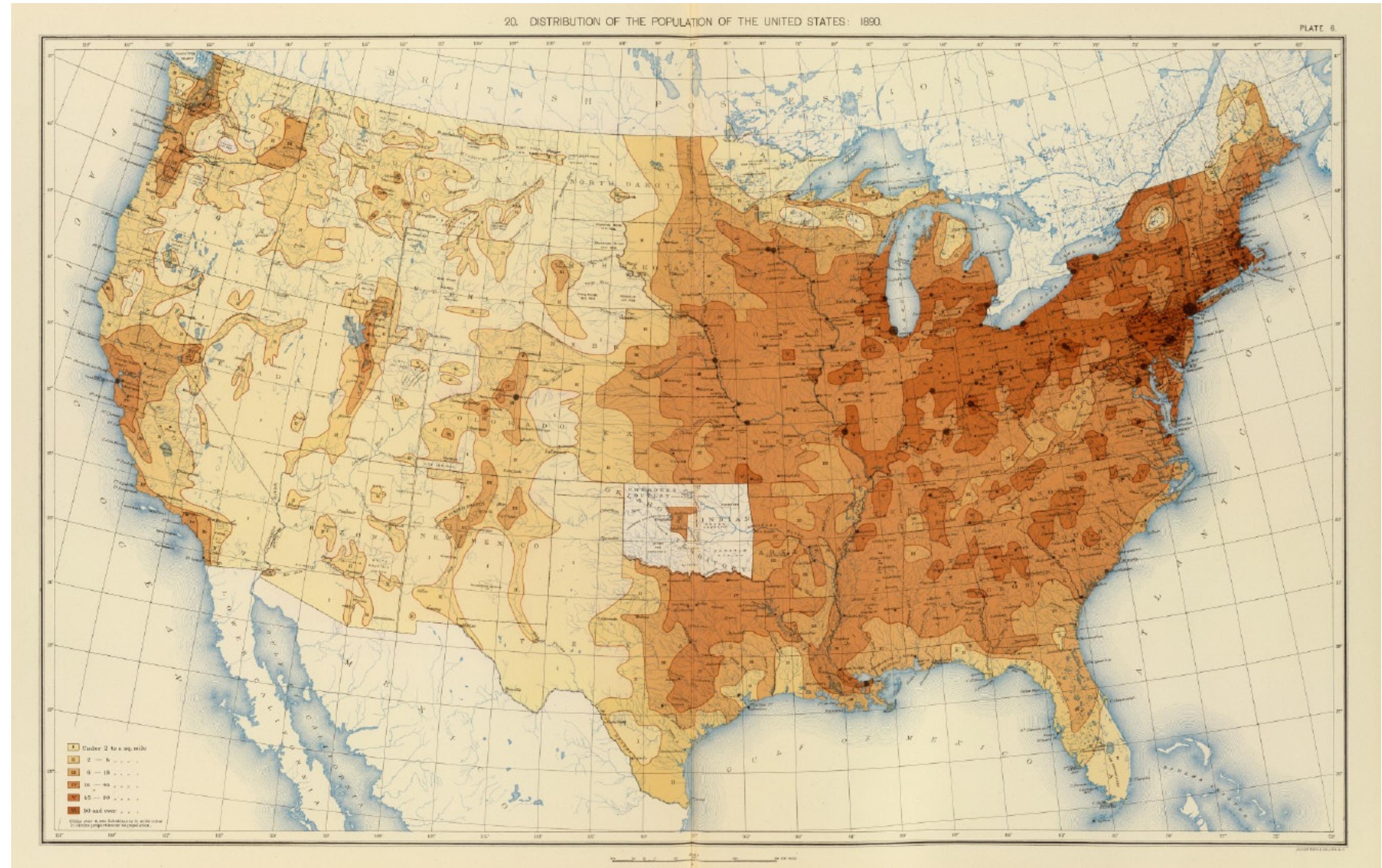
\* One electoral vote in Nebraska remains undecided. The state allocates its electoral votes on the basis of the results in each Congressional district. Only 569 votes separate John McCain and Barack Obama in unofficial returns from the 2nd District.

\* One electoral vote in Nebraska remains undecided. The state allocates its electoral votes on the basis of the results in each Congressional district. Only 569 votes separate John McCain and Barack Obama in unofficial returns from the 2nd District.

## Choropleth Map

# Isometric and Isopleth Maps





Isometric and  
Isopleth Maps

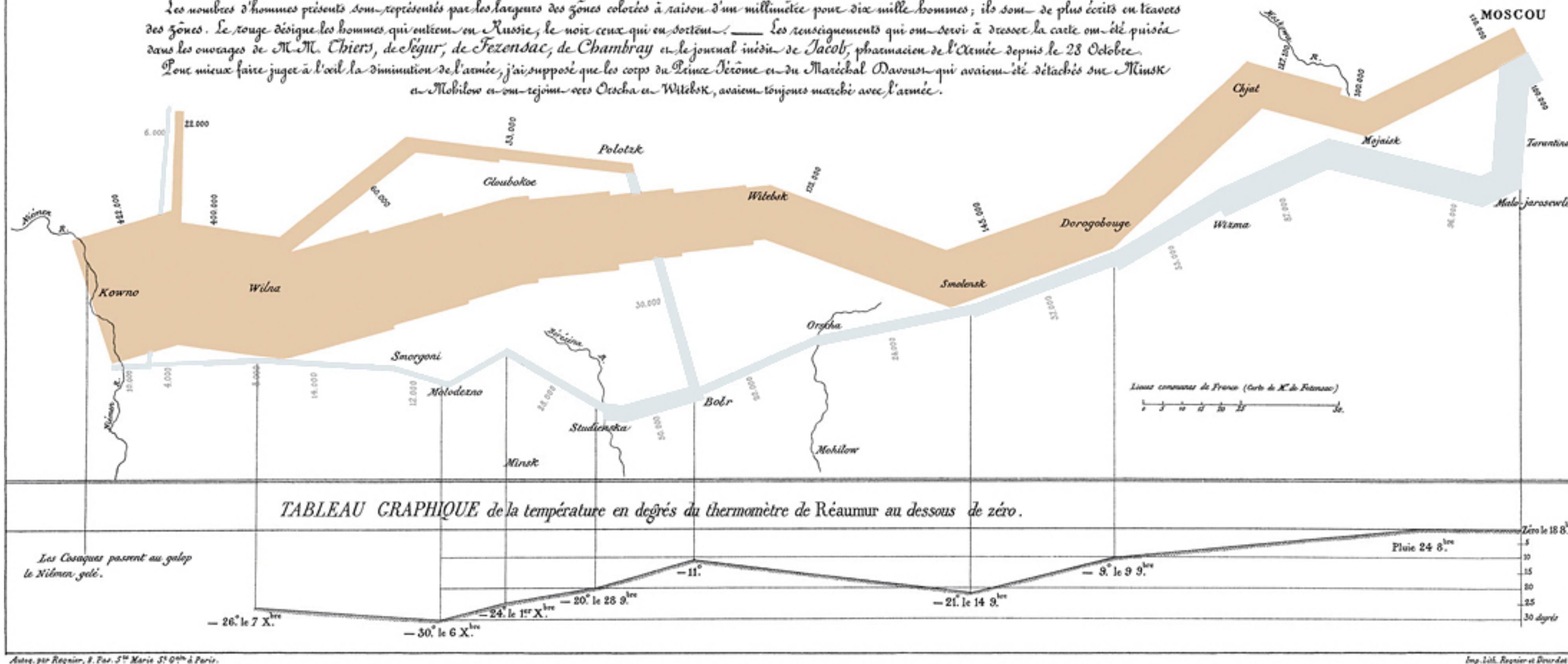
*Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.*

Dessiné par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869

Paris, le 20 Novembre 1869

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes ; ils sont de plus écrits en lettres des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Ségur, de Fezensac, de Chambray et le journal intitulé de Jacob, pharmacien de l'Académie depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout qui avaient été détachés sur Minsk et Malibow et qui rejoignirent vers Osscha en Witlobk, avaient toujours marché avec l'armée.



*TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.*

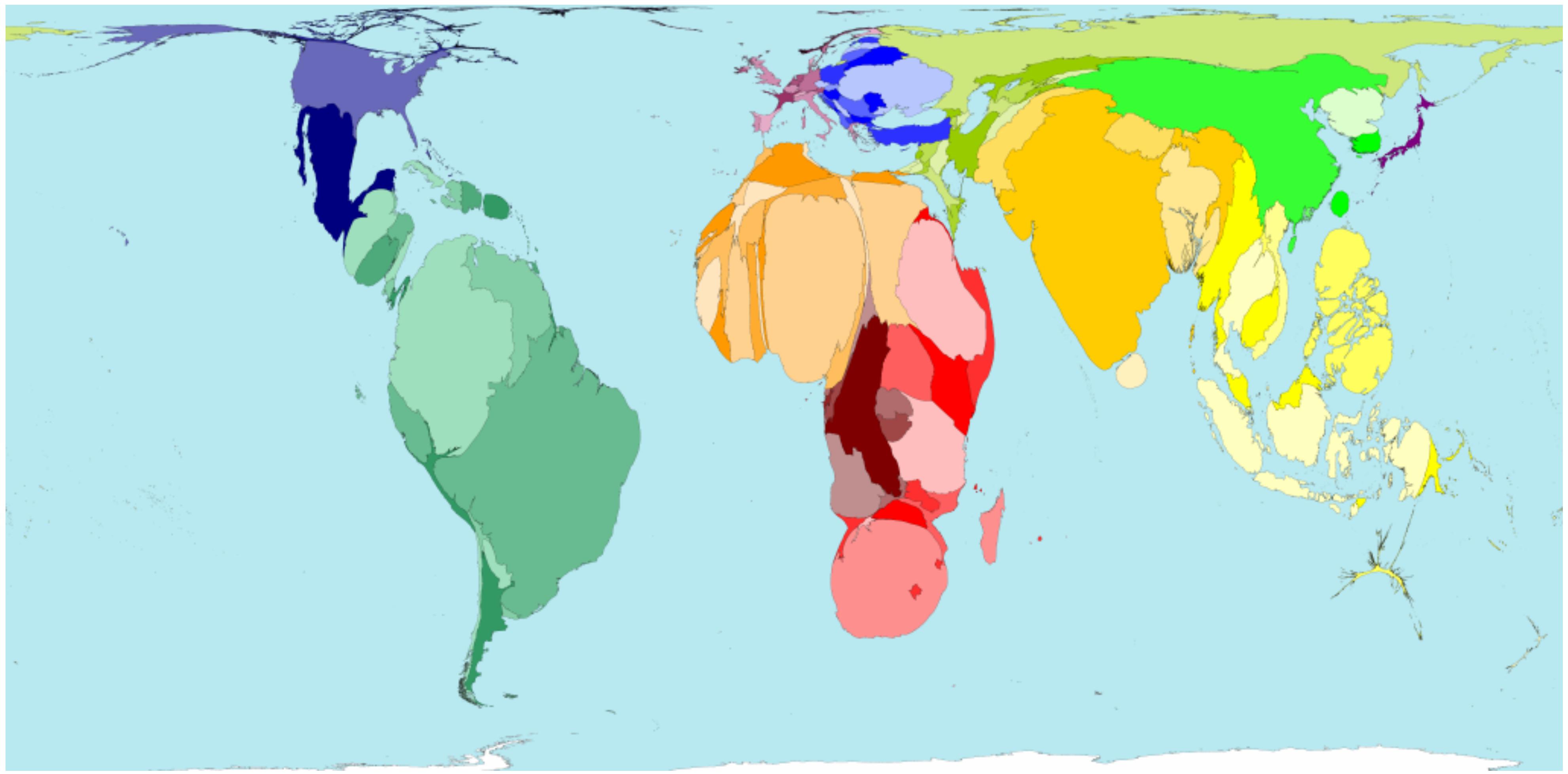
*Les Cosaques passent au galop  
le Nil sur galé.*

$-26^{\circ}$  le 7 X.<sup>bre</sup>       $-30^{\circ}$  le 6 X.<sup>bre</sup>       $-24^{\circ}$  le 1<sup>er</sup> X.<sup>bre</sup>

JMS-List: Revision of Standard

*Autograph Letter from St. Paul, 5<sup>th</sup> Maria, St. R<sup>th</sup> à Paris.*

# Flow and Network Map



Cartograms

# GEOGRAPHIC INFORMATION SYSTEMS

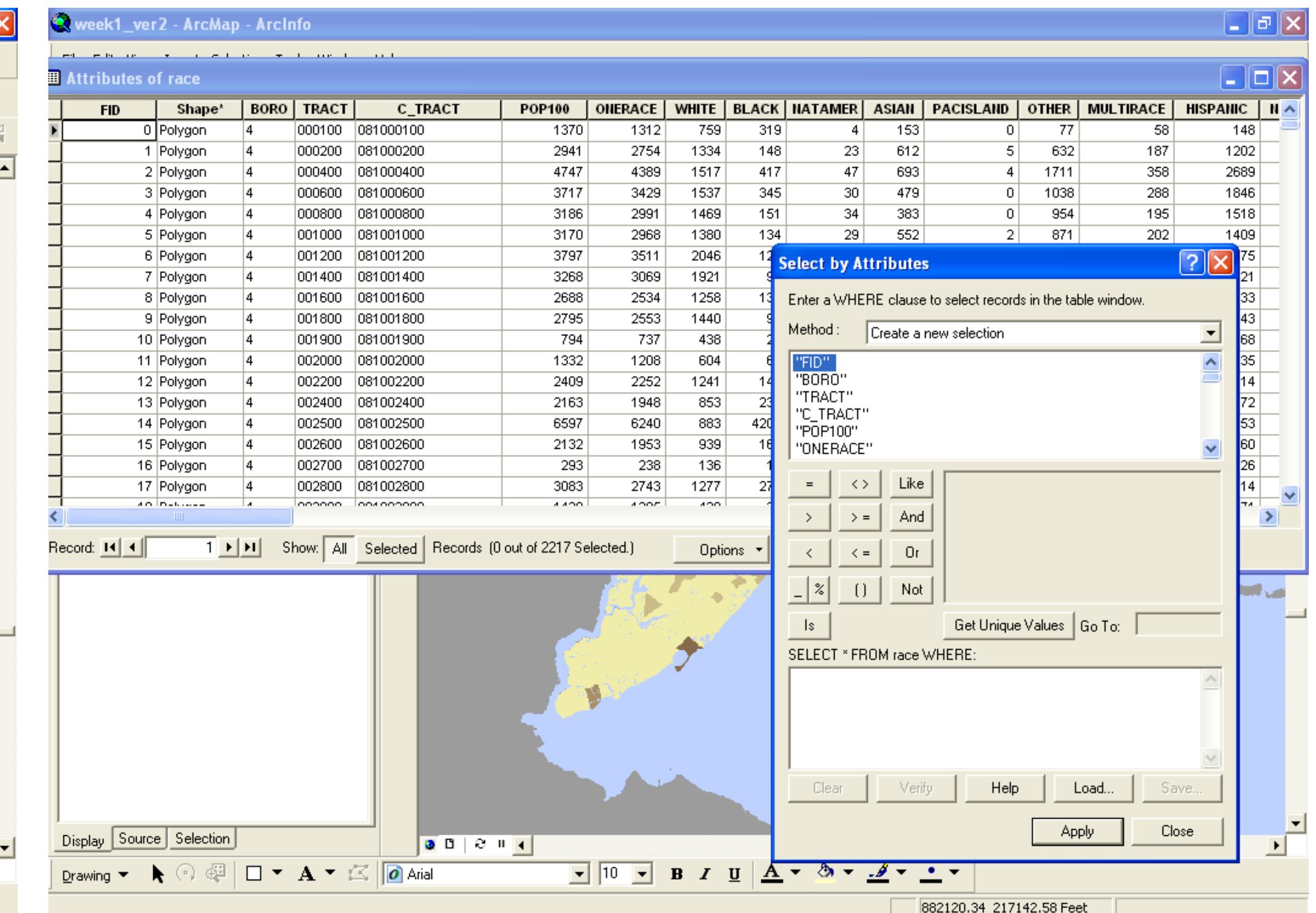
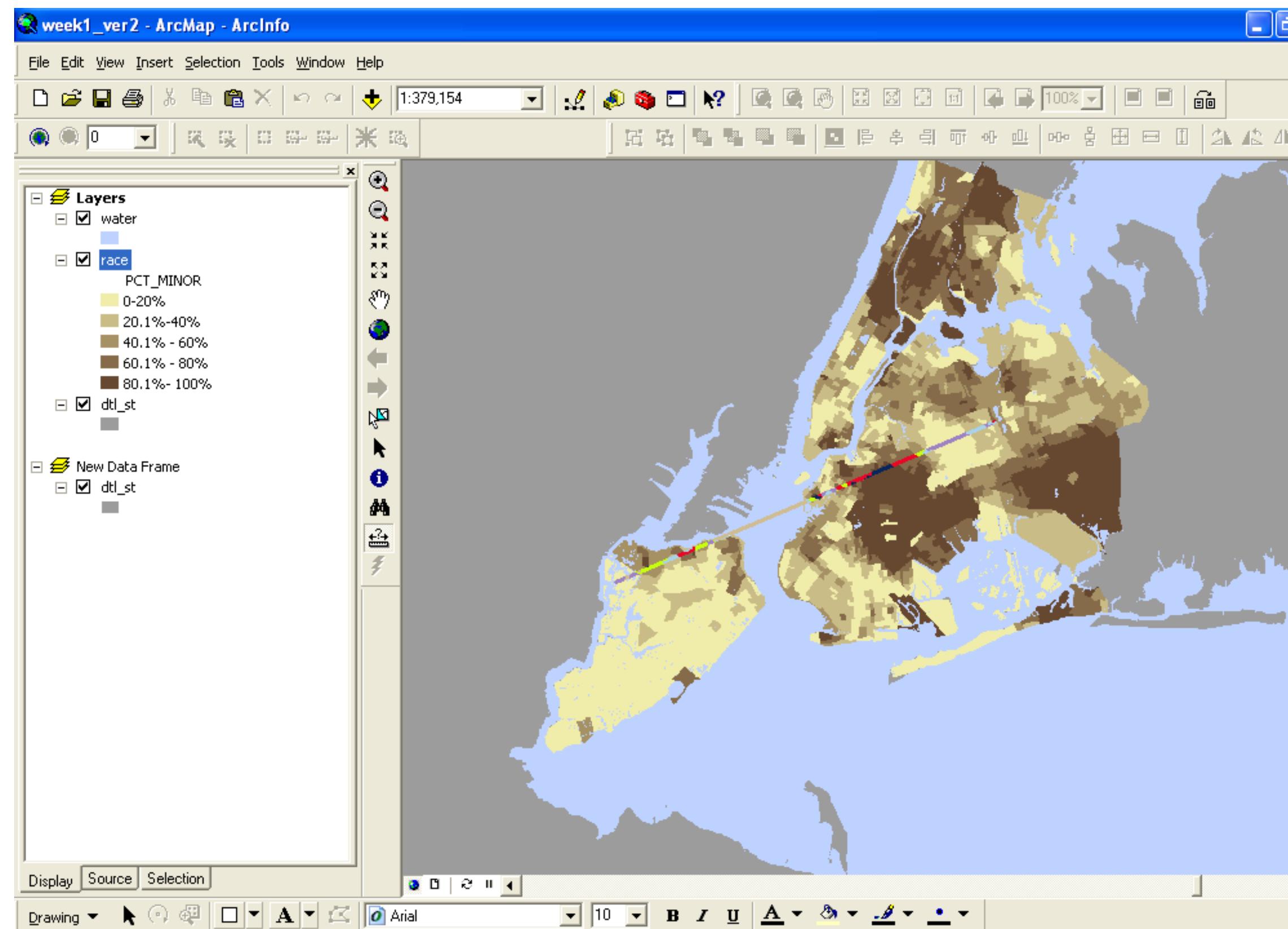
# STRUCTURE

- Geographic Information Systems are tools for managing data about where features are - *geographic coordinate data* - and what they are like - *attribute data* - and for providing the ability to *query*, *manipulate* and *analyze* that data.

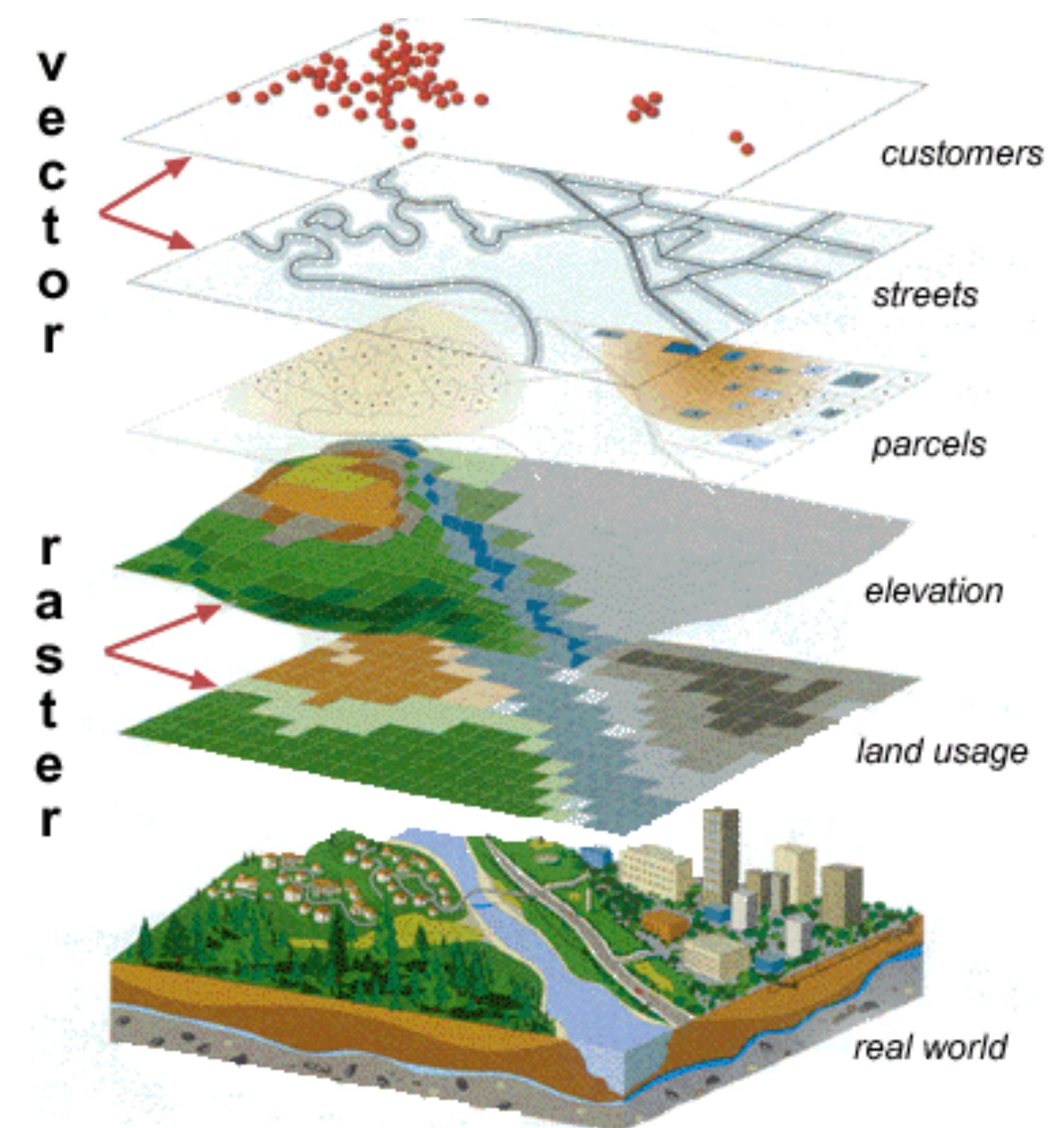


LOT	ASSESSYR	ST_NO	ADD_RANG	STREET	APT_NUM	OWNER
13	2001	523	0	WEST 121 STREET		SPENCER APARTMENTS IN
10	2001	527	0	WEST 121 STREET	24	COLUMBIA UNIVERSITY
9	2001	529	33	WEST 121 STREET		RC CHUR CORPUS CHRIST
6	2001	535	0	WEST 121 STREET		RC CHUR CORPUS CHRIST
1	2001	3060	70	BROADWAY		MUREL MANAGEMENT
29	2001	1220	38	AMSTERDAM AVENUE		TEACHERS COLLEGE COLU
1	2001	3040	46	BROADWAY		TEACHERS COLLEGE COLU
1	2001	530	0	WEST 120 STREET		TEACHERS COLLEGE
18	2001	1501	0	AMSTERDAM AVENUE		DEPT OF GENERAL SERVI
1	2001	499	0	WEST 133 STREET		BOARD OF EDUCATION
160	2001	496	0	WEST 133 STREET	15	496 WEST 133RD STREET
73	2001	1453	0	AMSTERDAM AVENUE	14	NEIGHBORHOOD PARTNRSH
72	2001	1455	0	AMSTERDAM AVENUE	18	FIRST WHGA DEV ASSOC
71	2001	1457	0	AMSTERDAM AVENUE	18	FIRST WHGA DEV ASSOC
70	2001	1459	0	AMSTERDAM AVENUE	18	FIRST WHGA DEV ASSOC
69	2001	1461	0	AMSTERDAM AVENUE	18	VITAL REALTY LLC
68	2001	1463	0	AMSTERDAM AVENUE	18	1463 AMSTREDAM AVENUE
67	2001	1465	0	AMSTERDAM AVENUE		DELPHI BUILDING INC

# SPATIAL - DATABASE



# LAYERS



# SCALES OF INFORMATION



# SPATIAL RELATIONSHIPS

- water quality and local health data
- temperature data and vegetation
- population and elevation
- land use and real estate values
- pollution and asthma rates
- distance (access) to parks and obesity rates

# GIS PROCESS

- research (research question, hypothesis, literature review)
- data acquisition (data mining, remote sensing, collecting data)
- data storage and retrieval
- data processing (file formats, sampling)
- data display and interaction
- data analysis
- data presentation (final maps, animations, web-maps, charts and graphs)