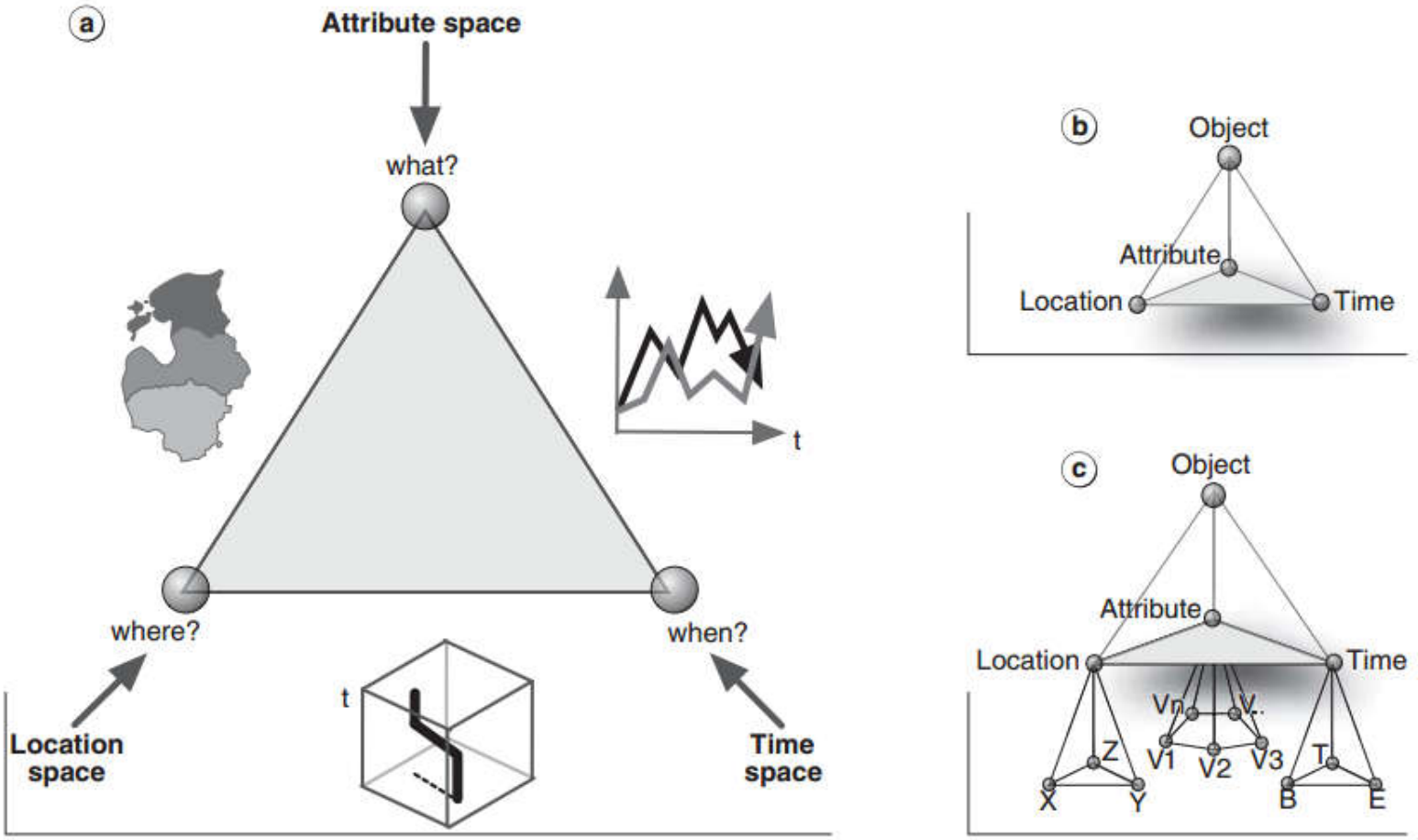
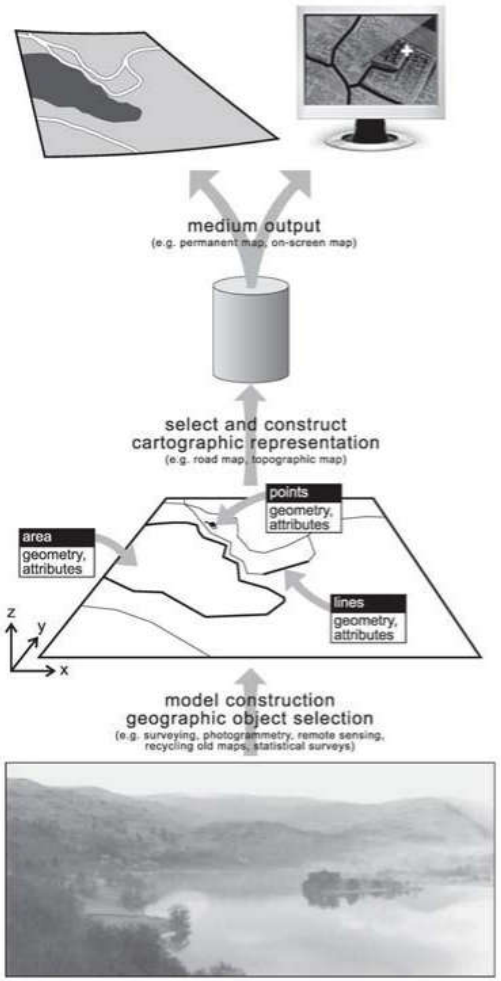
Geovisualization

Alex Godwin

For each country on earth, we have a GDP value. Sketch (really only sketch) three ideas how you would encode that information using a geographic map.
[2 min]



Kraak, Menno-Jan, and Ferjan Ormeling. Cartography: visualization of spatial data. Guilford Press, 2011.



Cognitive map: interpretation of reality by map reader / analyst

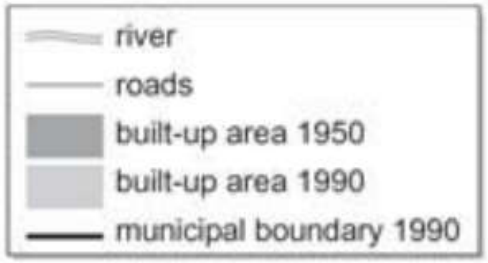
Map: physical or on-screen

Digital cartographic model: translation of landscape to visual parameters

Digital Landscape Model: captured representation of the important aspects of reality as data

Reality: confusing and often subjective

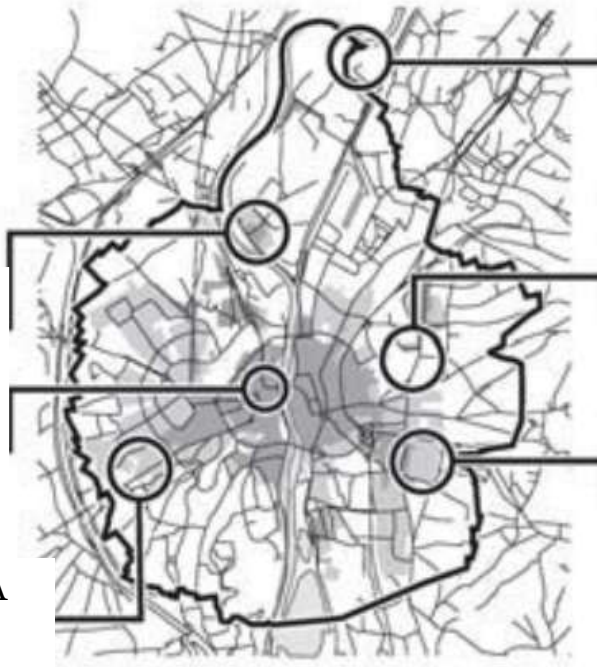
Kraak, Menno-Jan, and Ferjan Ormeling. Cartography: visualization of spatial data. Guilford Press, 2011.



what is the name of this village?
Identification: Borgharen

where is the city hall?
location: x,y = 1764,3180

What is the shortest route between A and B?
optimal path: start at A, go left at …

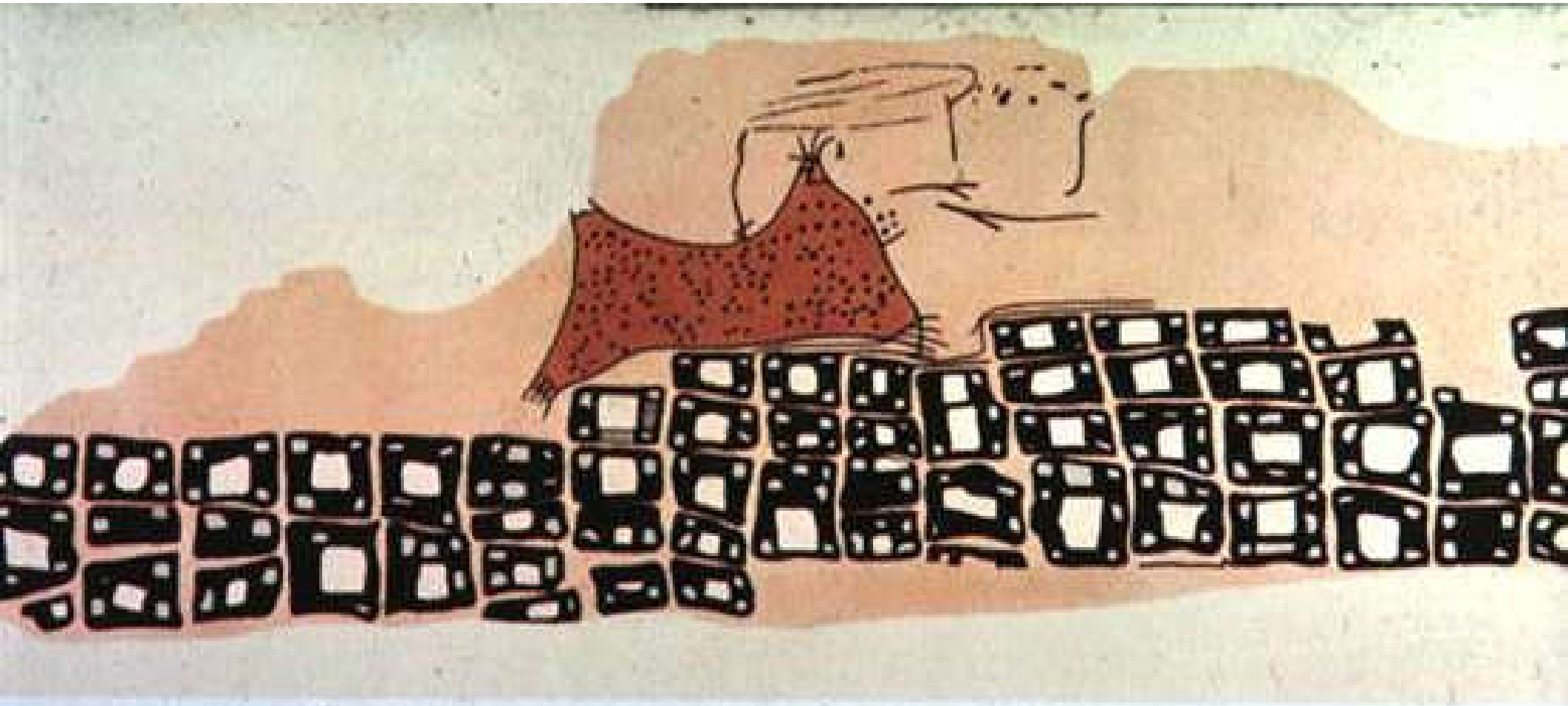


What relation exists between road network and river?
Pattern: river interrupts road network

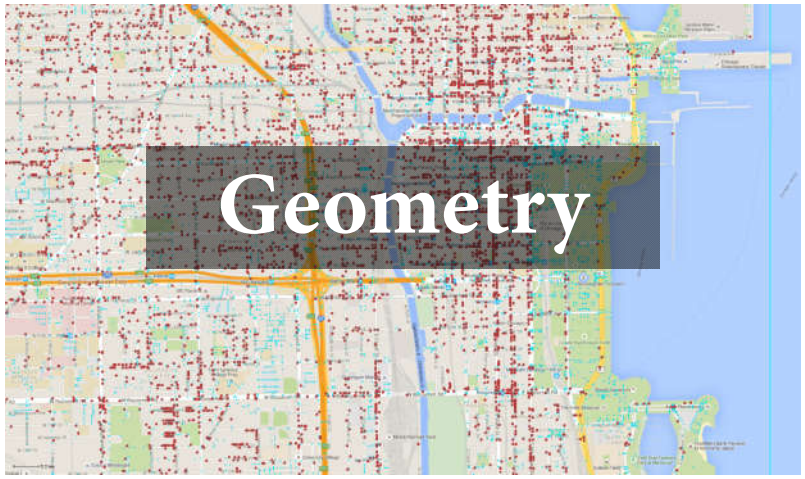
What if: a new built-up area is created here?
models: will affect traffic intensity

What has changed?
trends: growth urban area

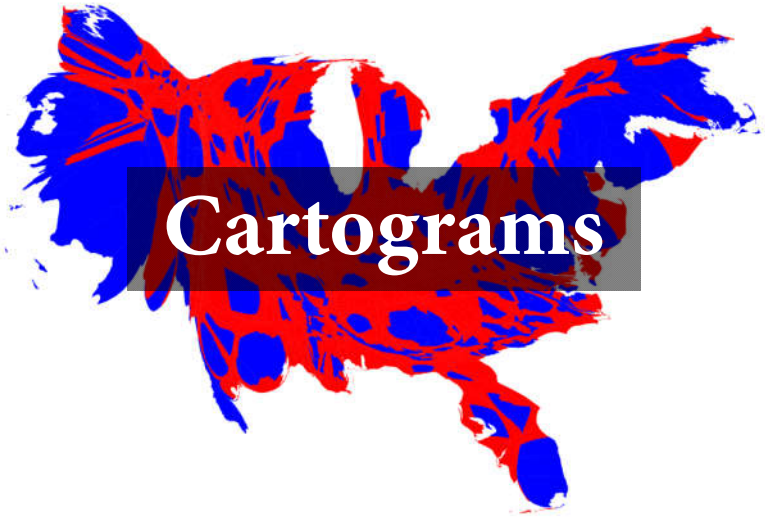
Kraak, Menno-Jan, and Ferjan Ormeling. Cartography: visualization of spatial data. Guilford Press, 2011.



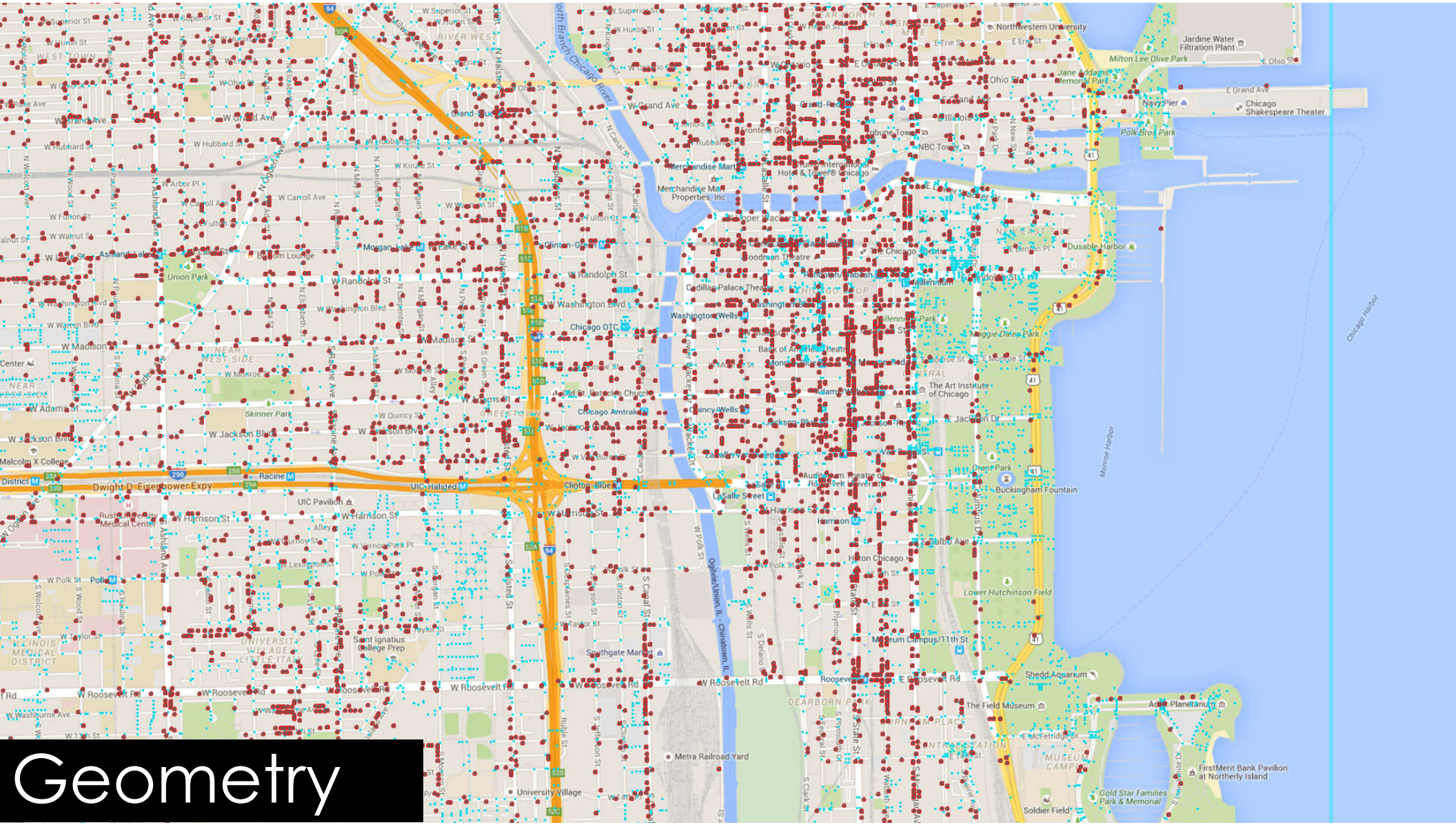
Schmitt AK et al. 2014. Identifying the Volcanic Eruption Depicted in a Neolithic Painting at Çatalhöyük, Central Anatolia, Turkey. PLoS ONE 9 (1): e84711; doi: 10.1371/journal.pone.0084711

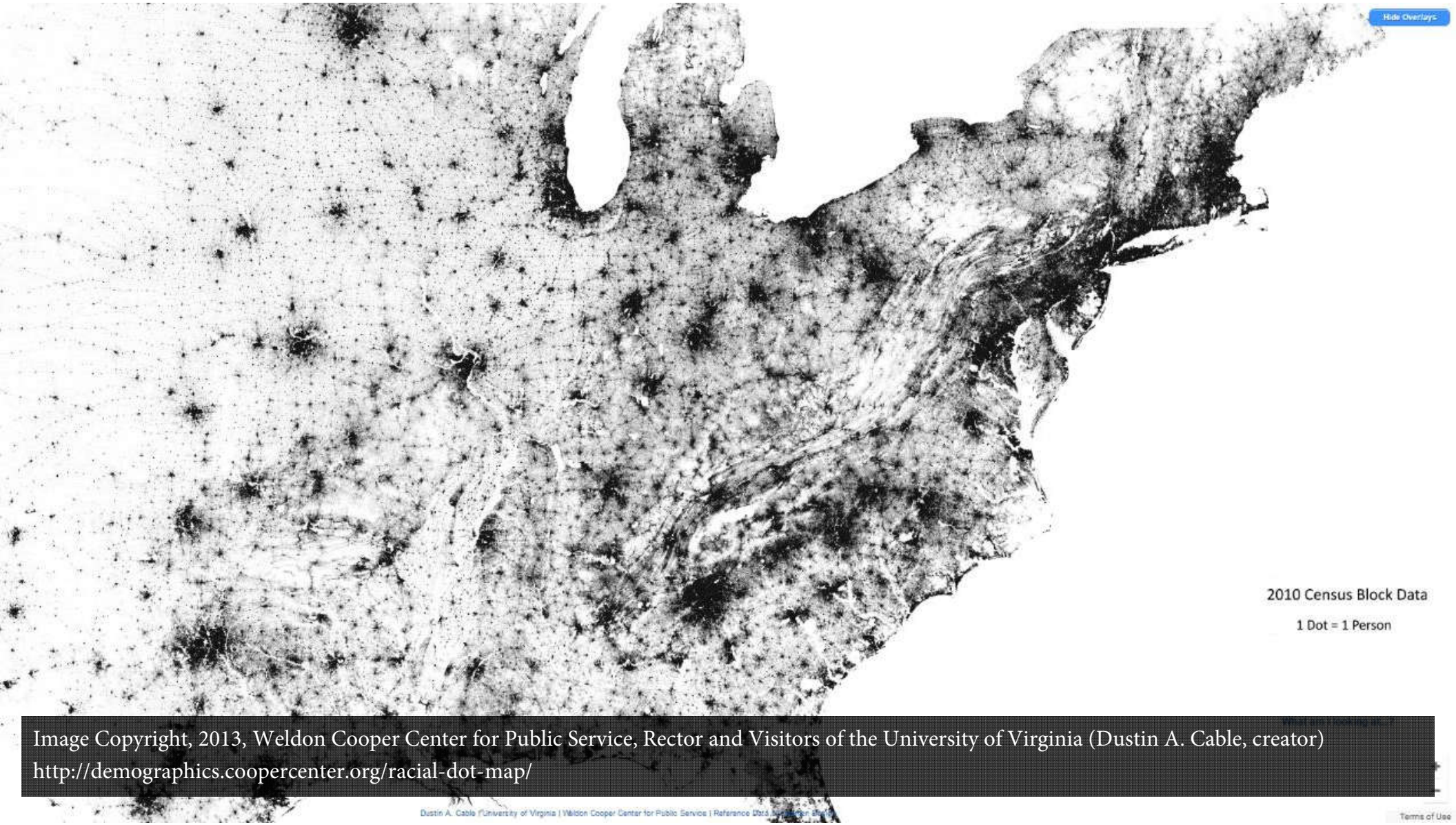

Geometry

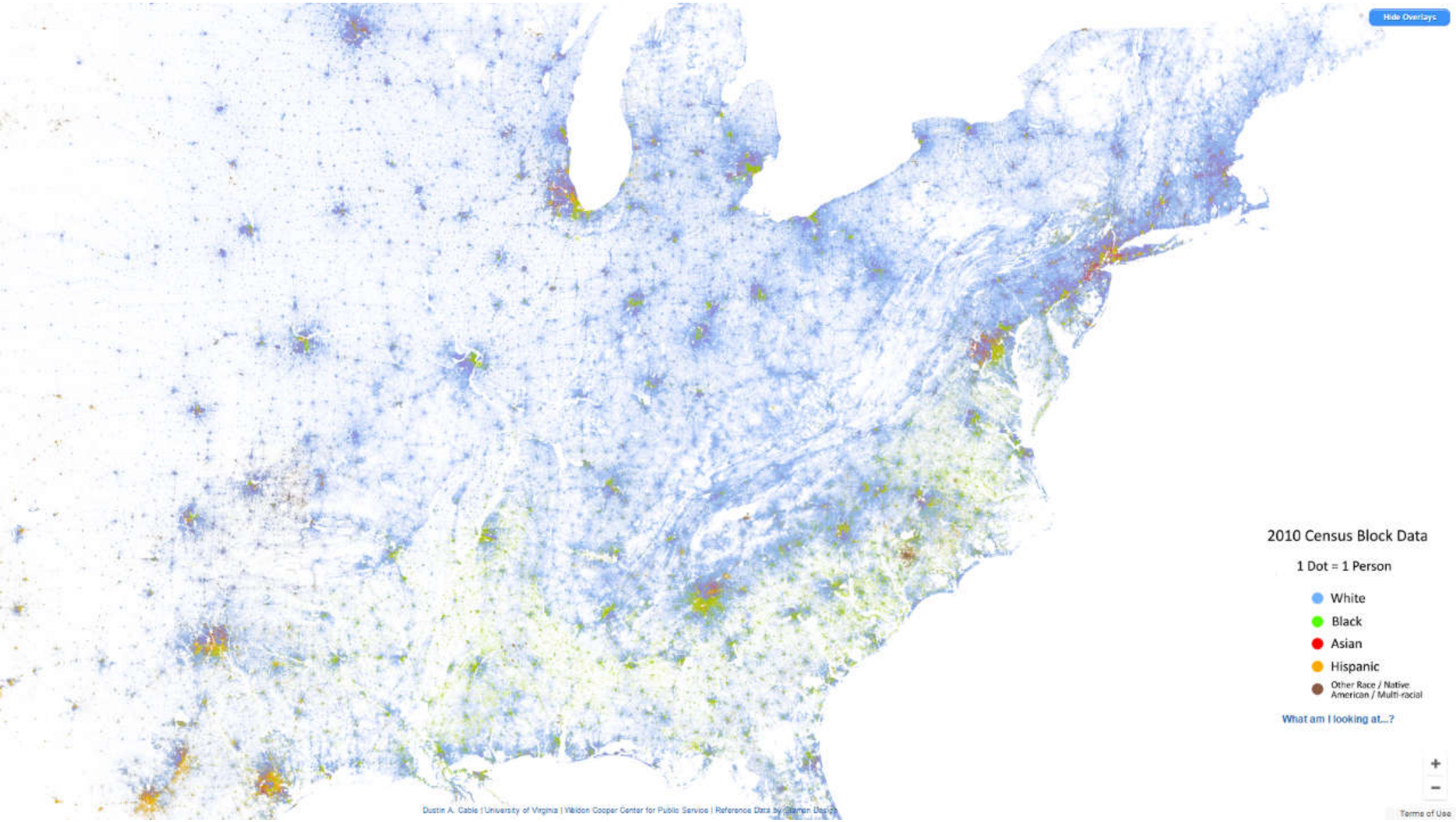

Choropleth

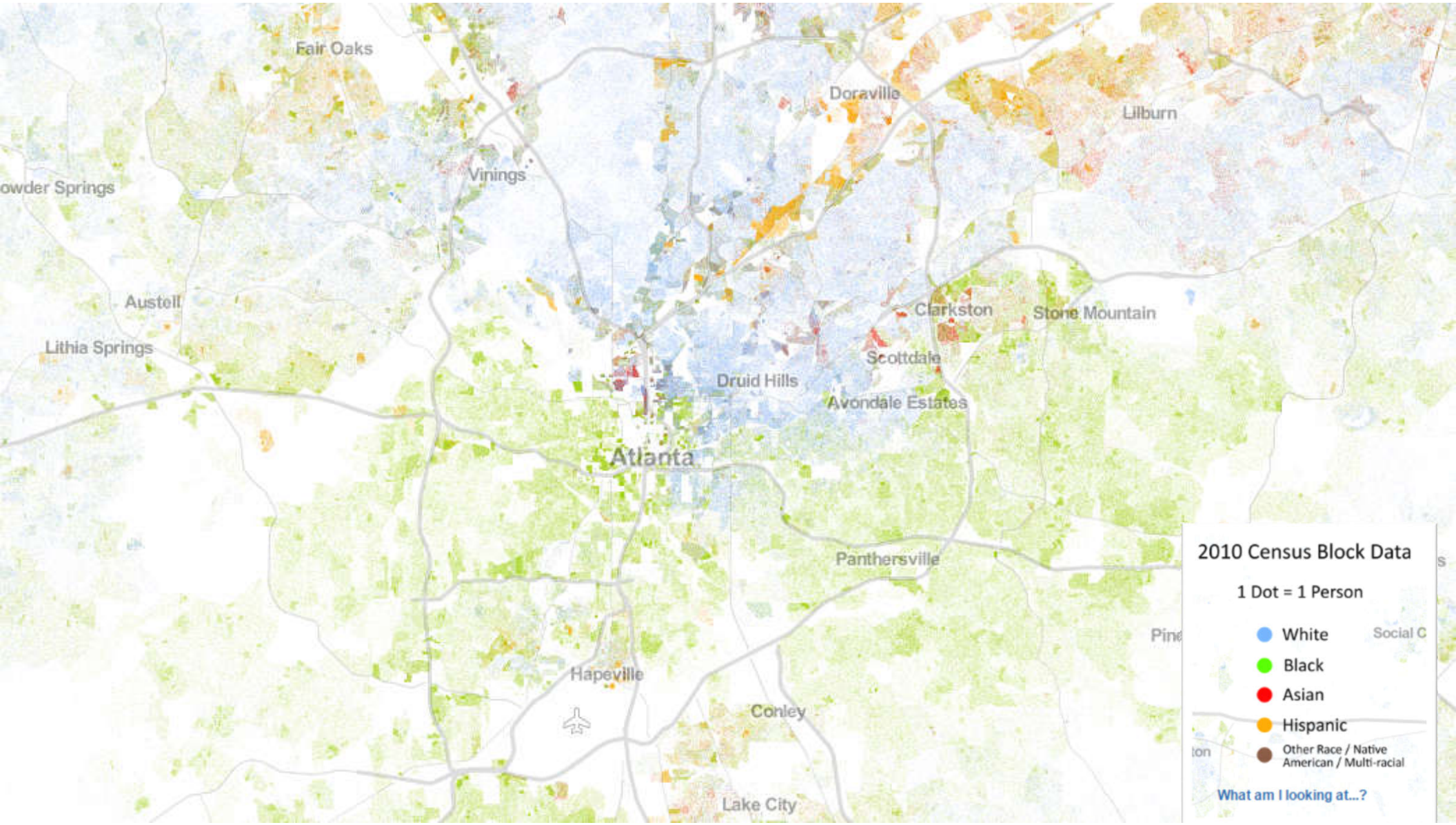

Cartograms


Fields / Lines


Geometry




Hide Overlays
2010 Census Block Data
1 Dot = 1 Person
White
Black
Asian
Hispanic
Other Race / Native American / Multi-racial
What am I looking at...?
Dustin A. Cable | University of Virginia | Weldon Cooper Center for Public Service | Reference Data by Stamen Design
Terms of Use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Avondale Estates
Atlanta
Panthersville
Hapeville
Conley
Lake City
2010 Census Block Data
1 Dot = 1 Person
White
Black
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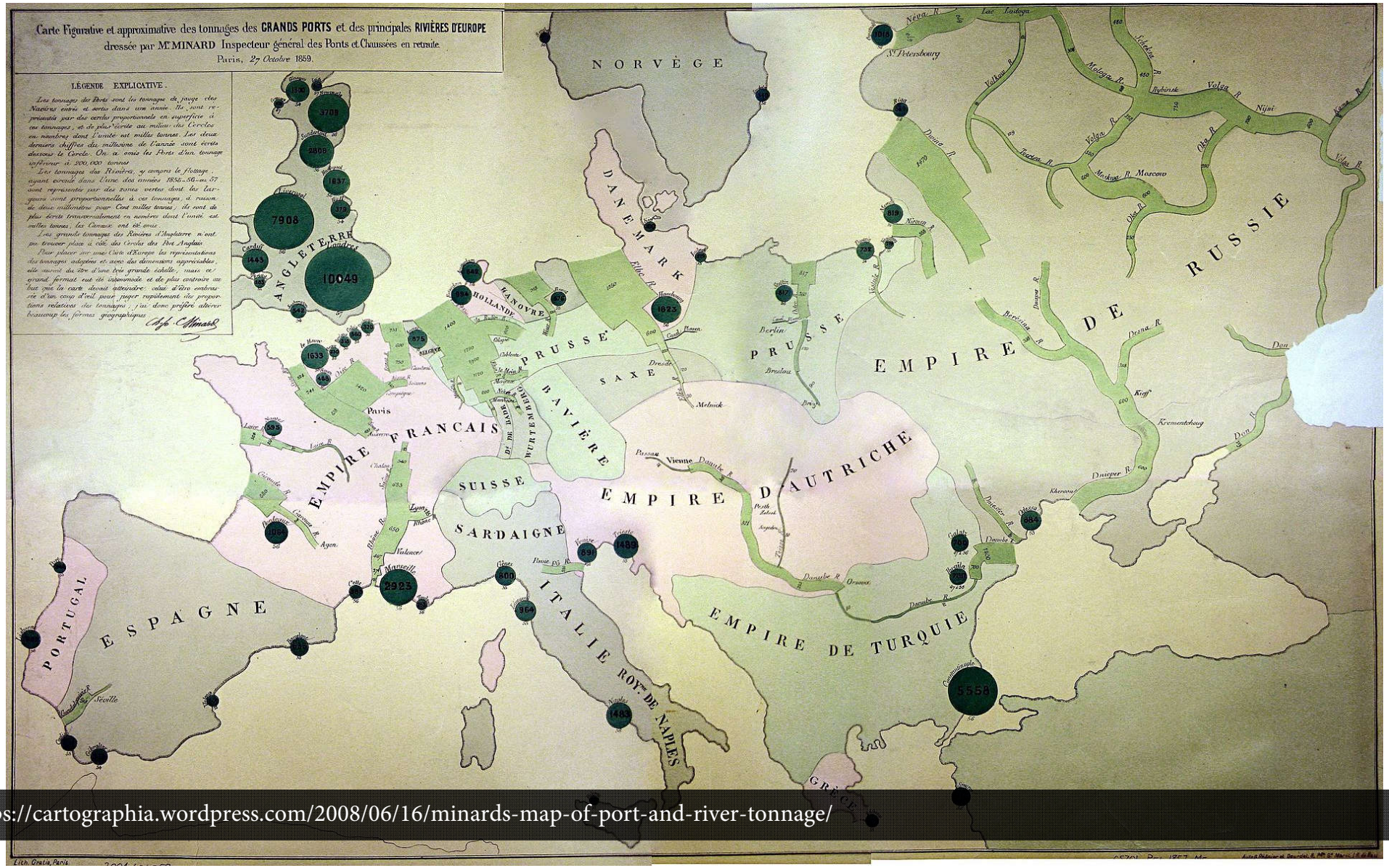
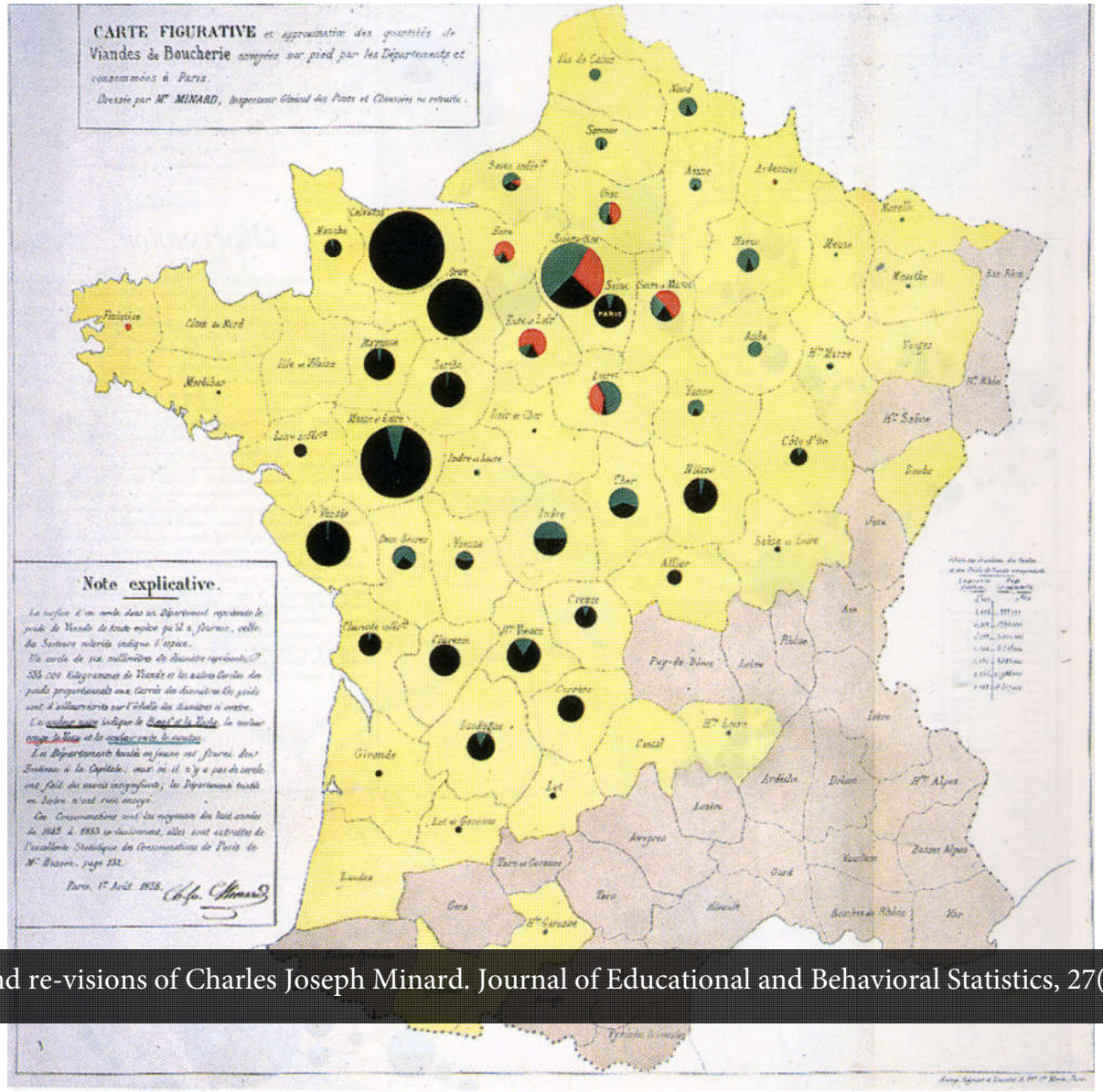
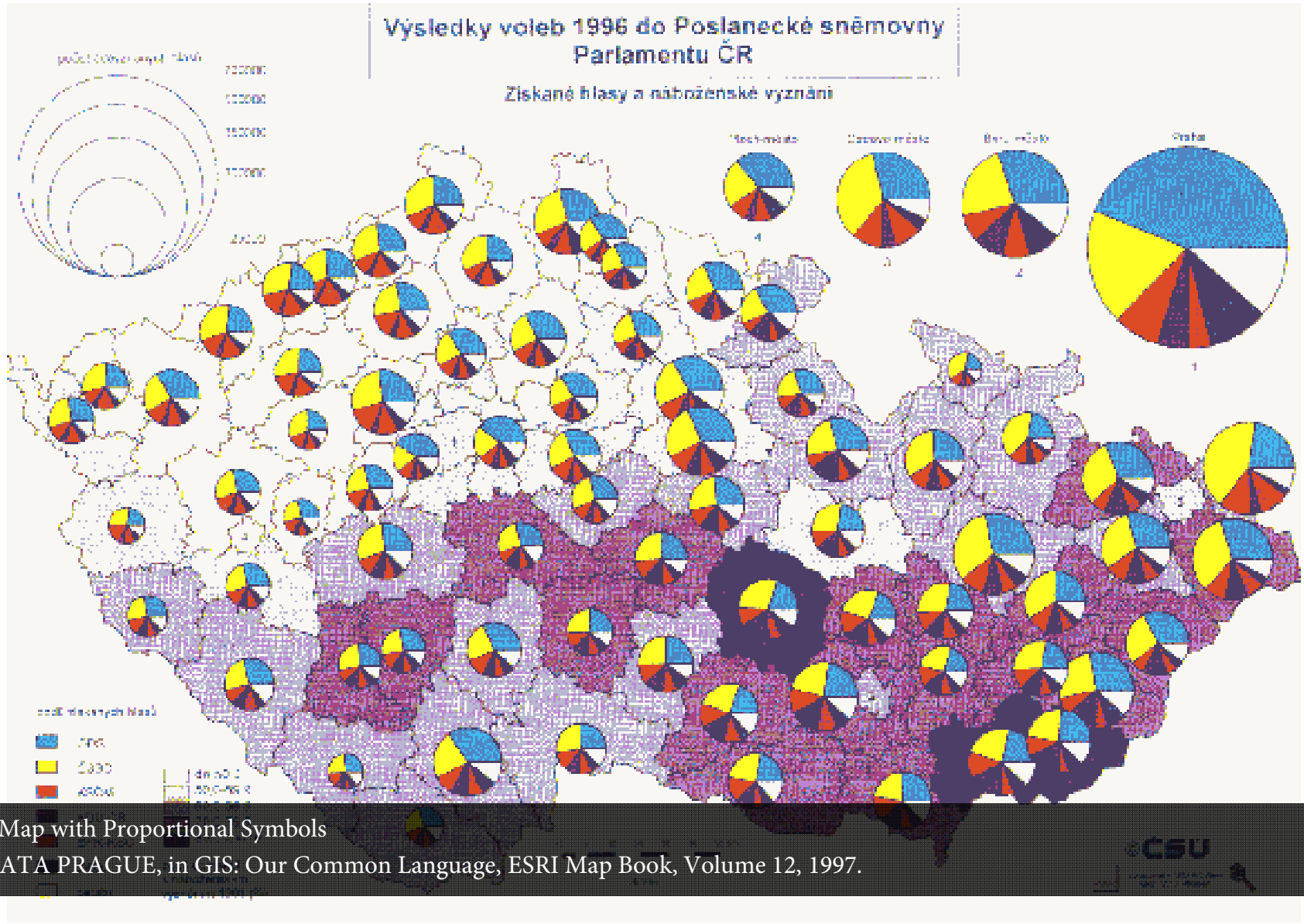
Hispanic
Other Race / Native American / Multi-racial
What am I looking at...?

Tufte, E. R. (1997). Visual and statistical thinking: Displays of evidence for making decisions (Vol. 13). Cheshire, CT: Graphics Press.

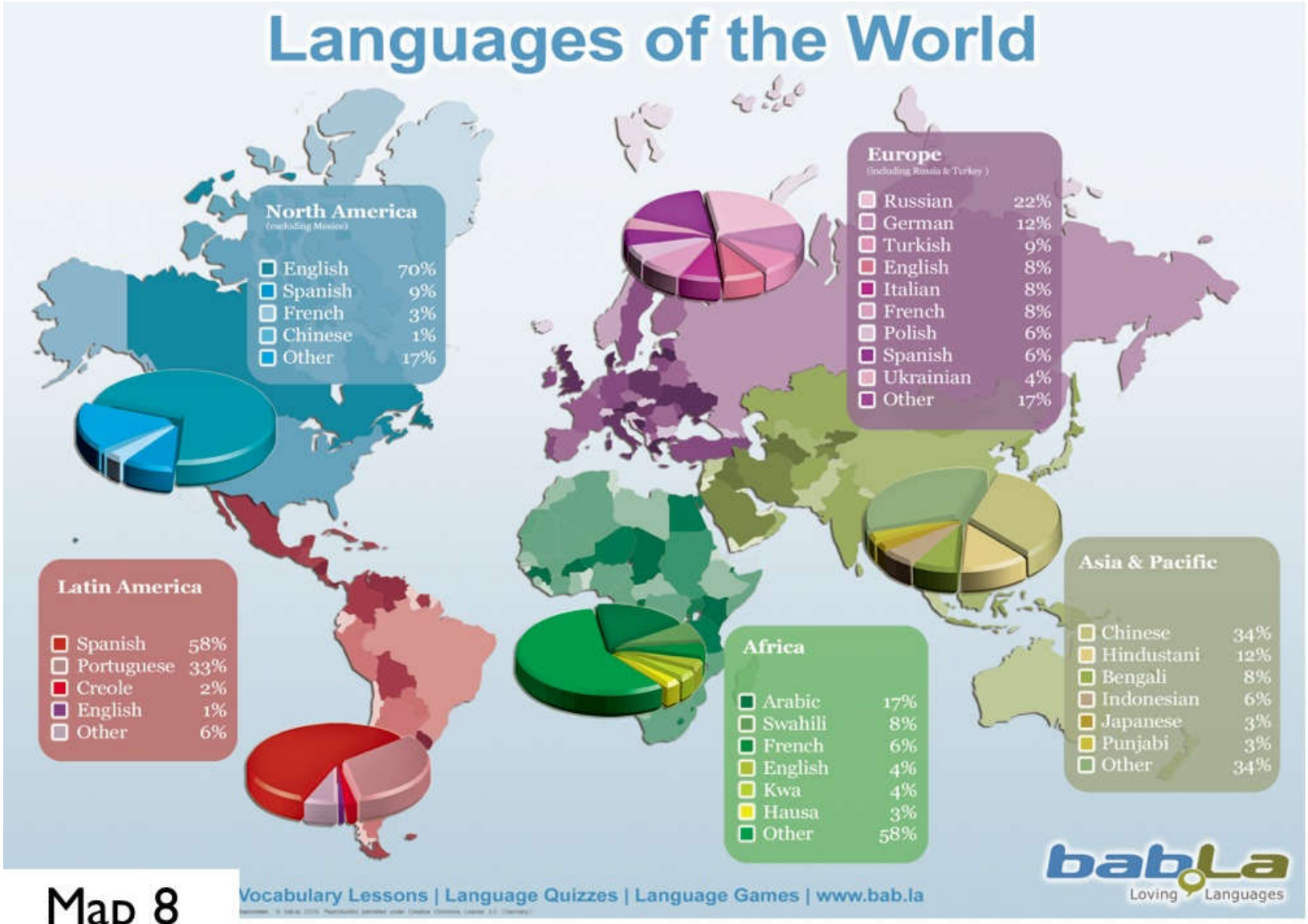




Friendly, M. (2002). Visions and re-visions of Charles Joseph Minard. Journal of Educational and Behavioral Statistics, 27(1), 31-51

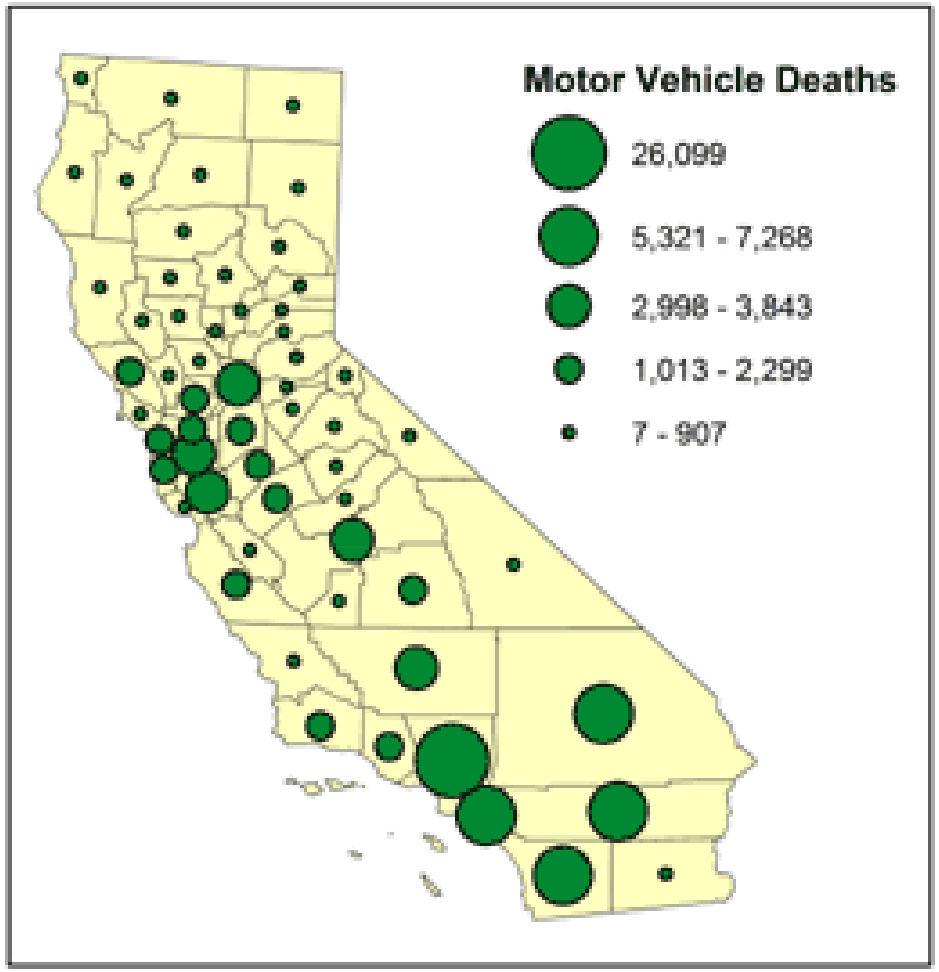


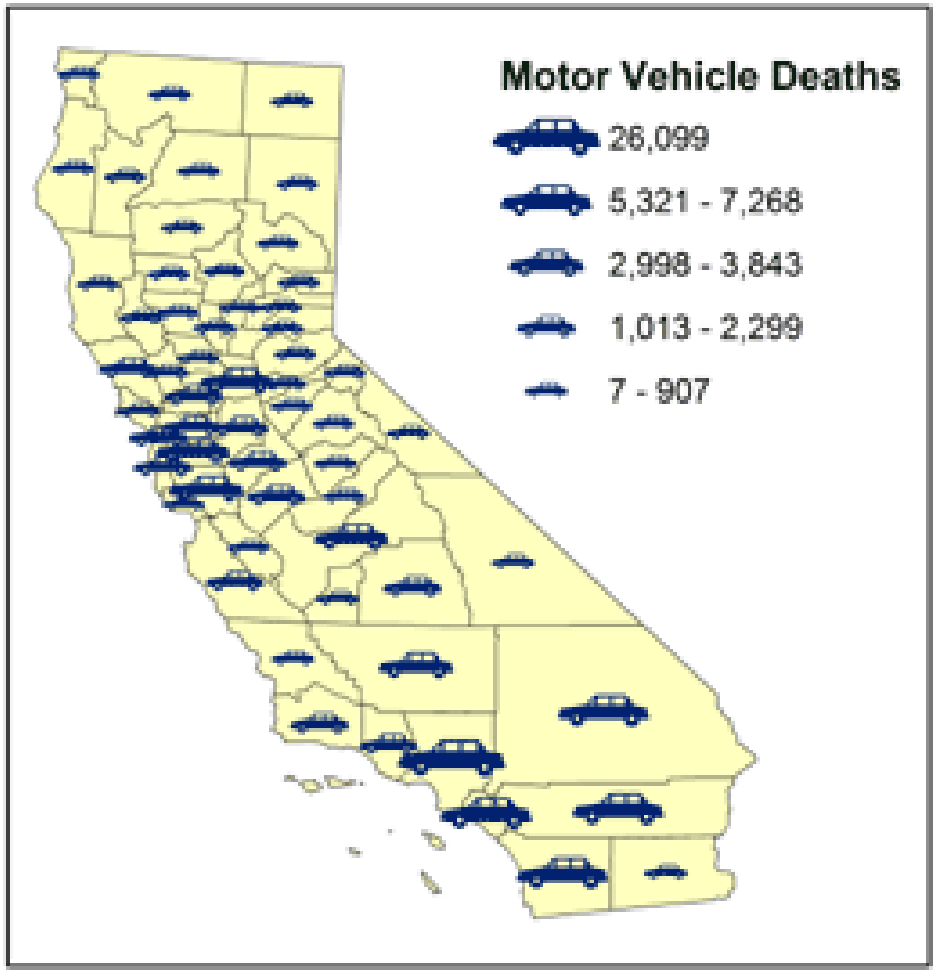
Choropleth Map with Proportional Symbols
from ARCDATA PRAGUE, in GIS: Our Common Language, ESRI Map Book, Volume 12, 1997.



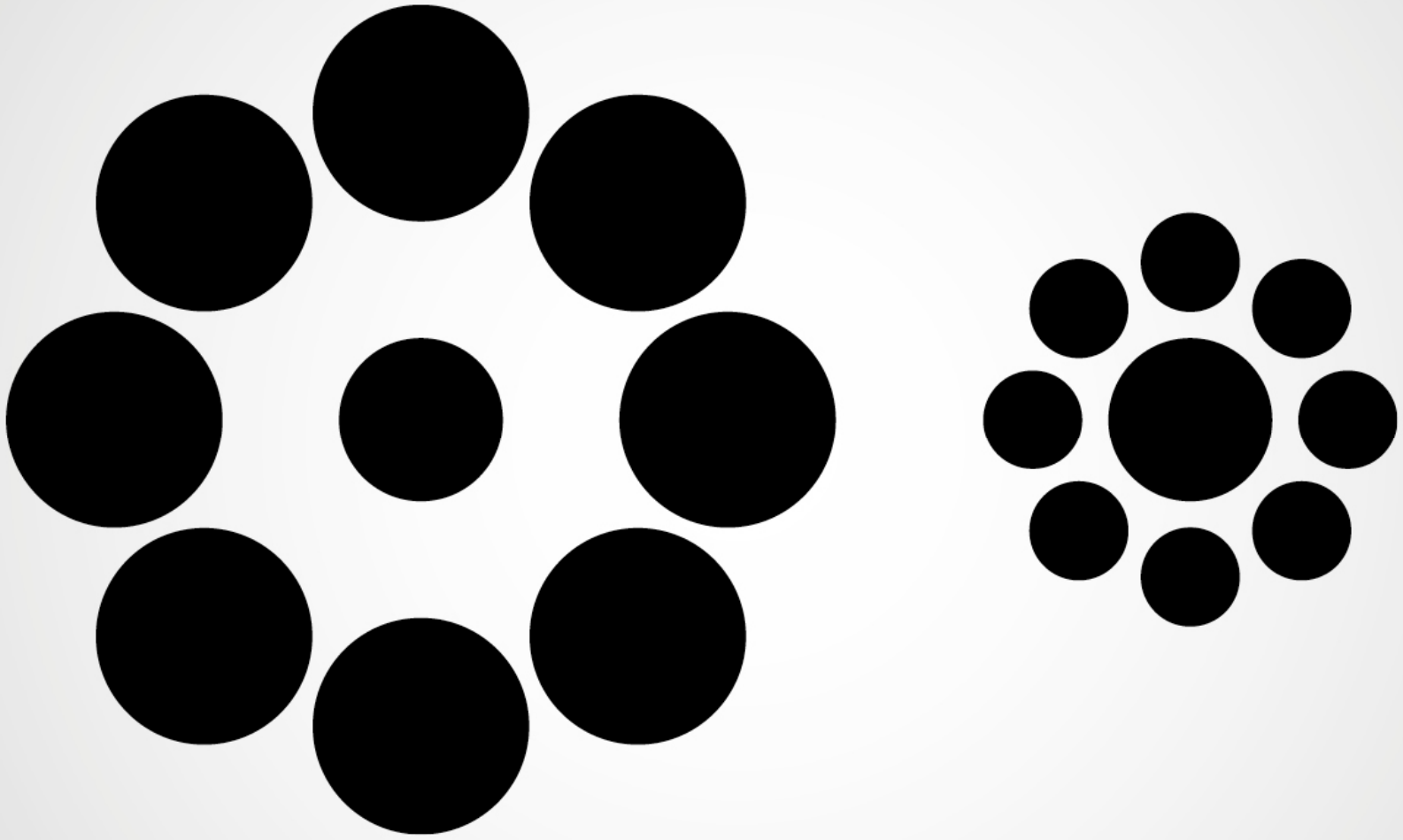
Map 8

http://en.bab.la/news/world-languages.html

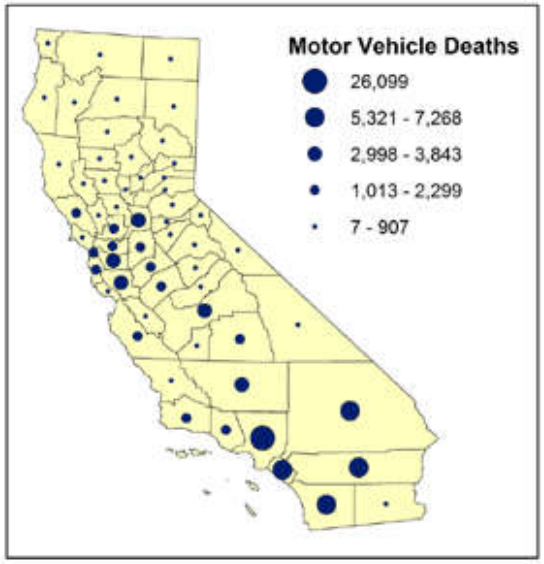


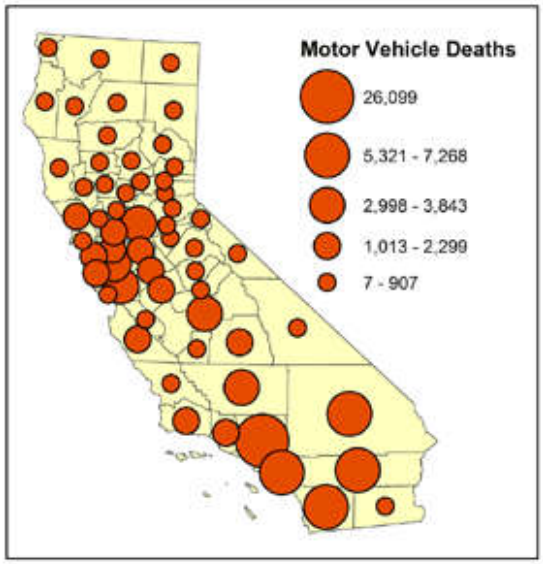


Gruver, A. Graduated and Proportional Symbol Maps. https://www.e-education.psu.edu/geog486/node/1869



Ebbinghaus, H. The Ebbinghaus Illusion. https://en.wikipedia.org/wiki/Ebbinghaus_illusion


Motor Vehicle Deaths
26,099
5,321 - 7,268
2,998 - 3,843
1,013 - 2,299
7 - 907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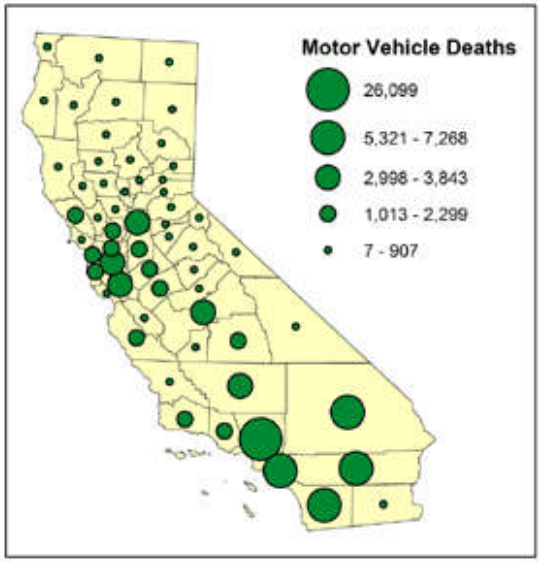
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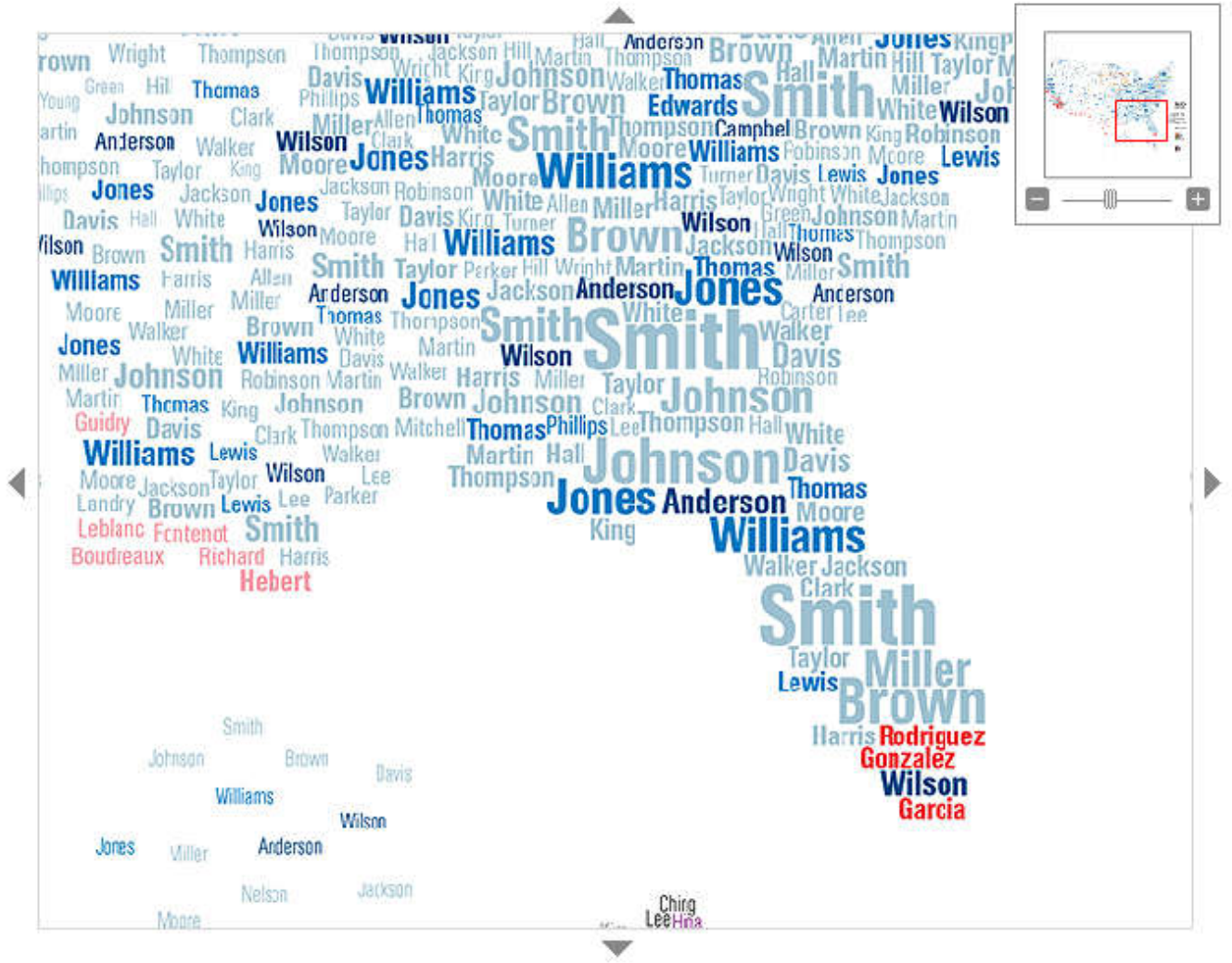
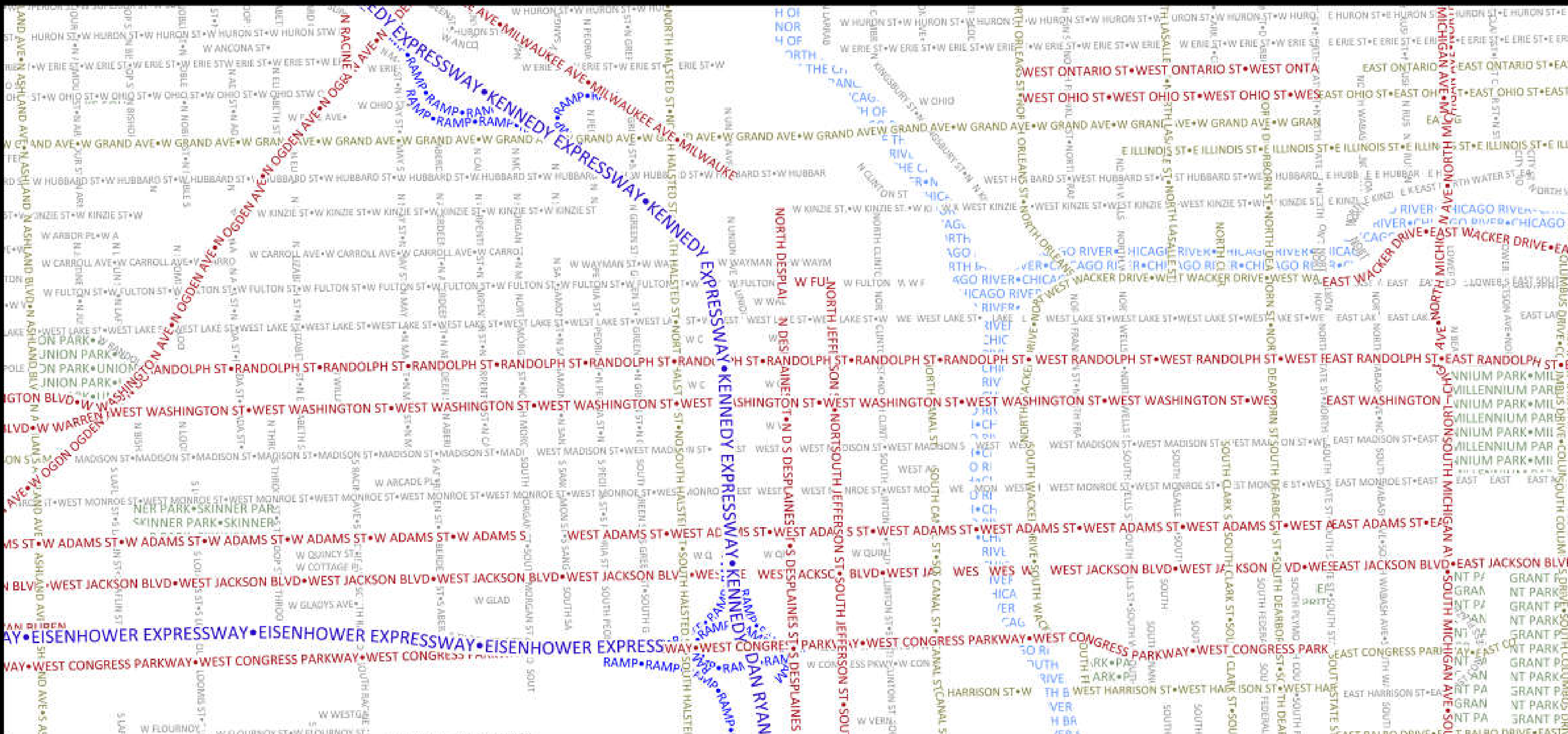
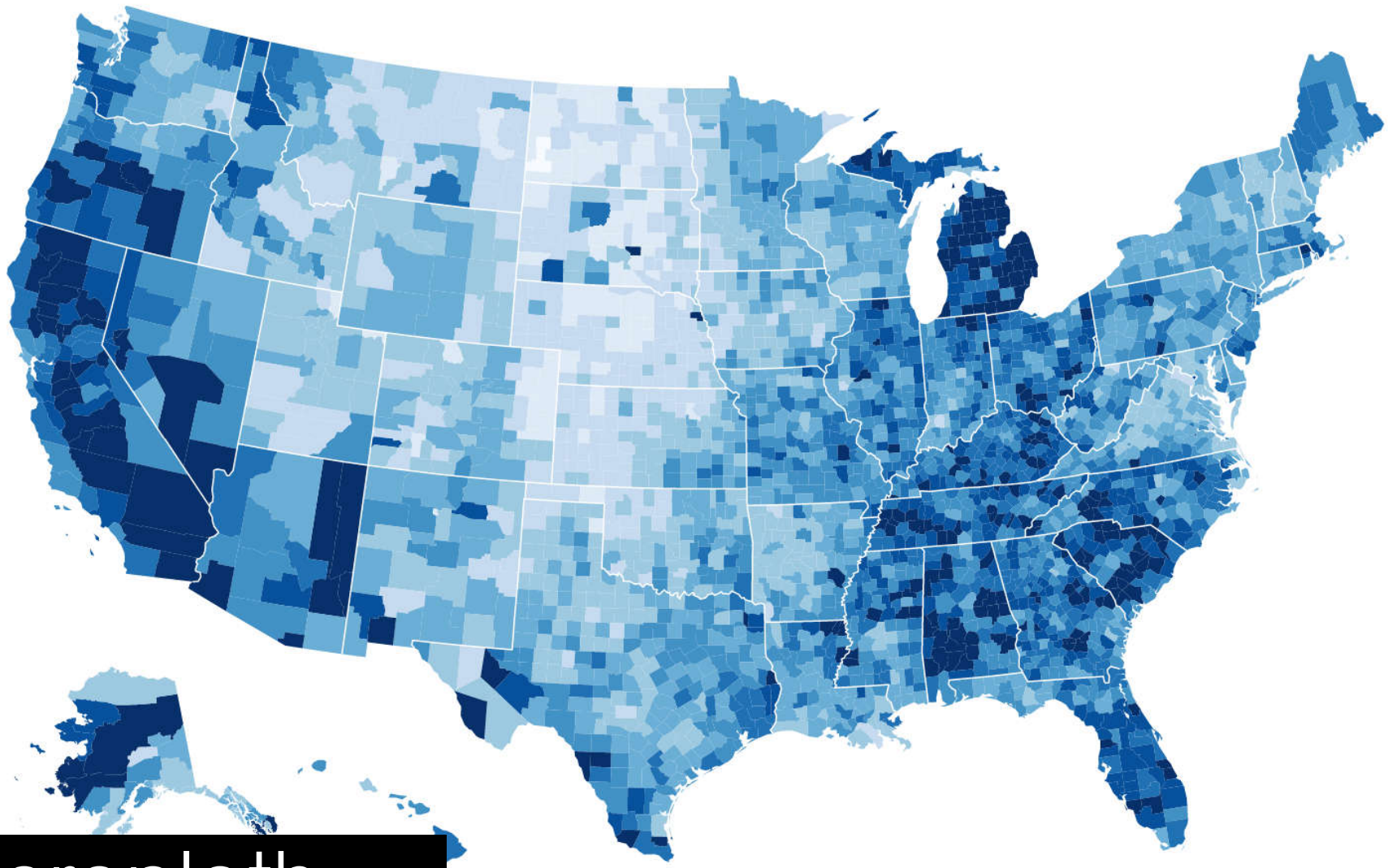


2011. “What’s in a Surname?”, National Geographic. http://ngm.nationalgeographic.com/2011/02/geography/usa-surnames-interactive

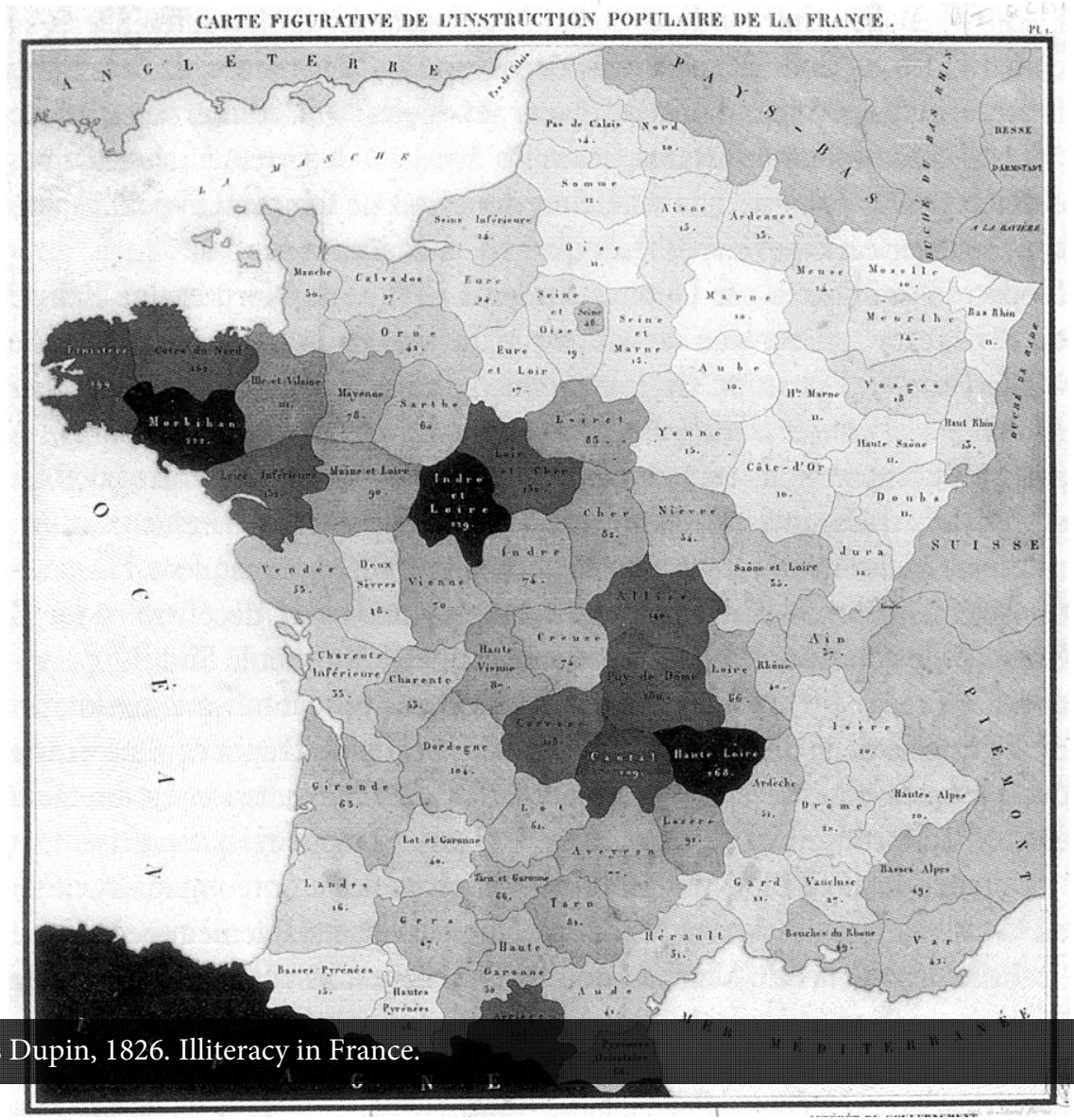


Afzal, S., Maciejewski, R., Jang, Y., Elmqvist, N., & Ebert, D. S. (2012). Spatial text visualization using automatic typographic maps. IEEE Transactions on Visualization and Computer Graphics, 18(12), 2556-2564.

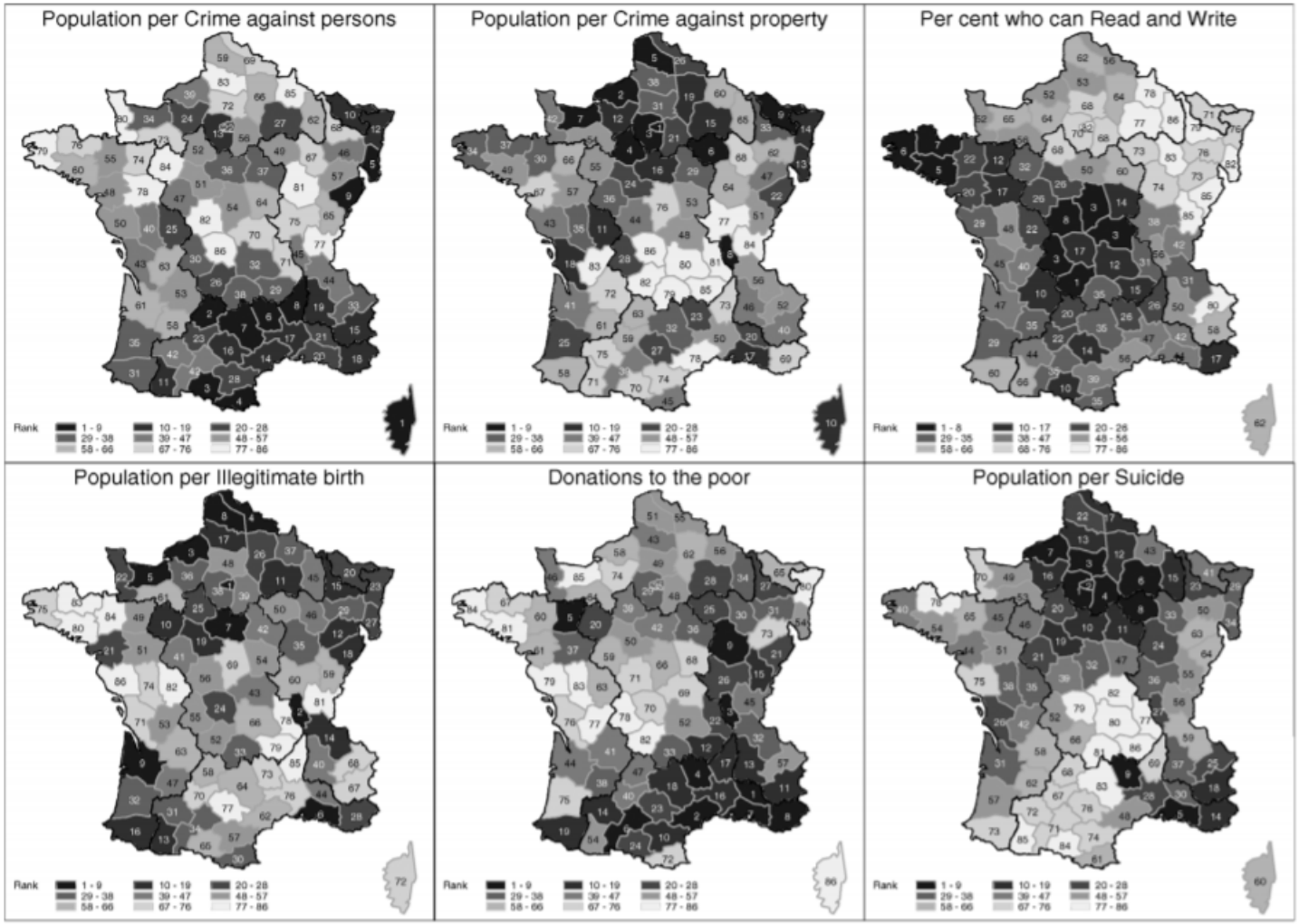
Godwin, A., Wang, Y., & Stasko, J. T. TypoTweet Maps: Characterizing Urban Areas through Typographic Social Media Visualization.



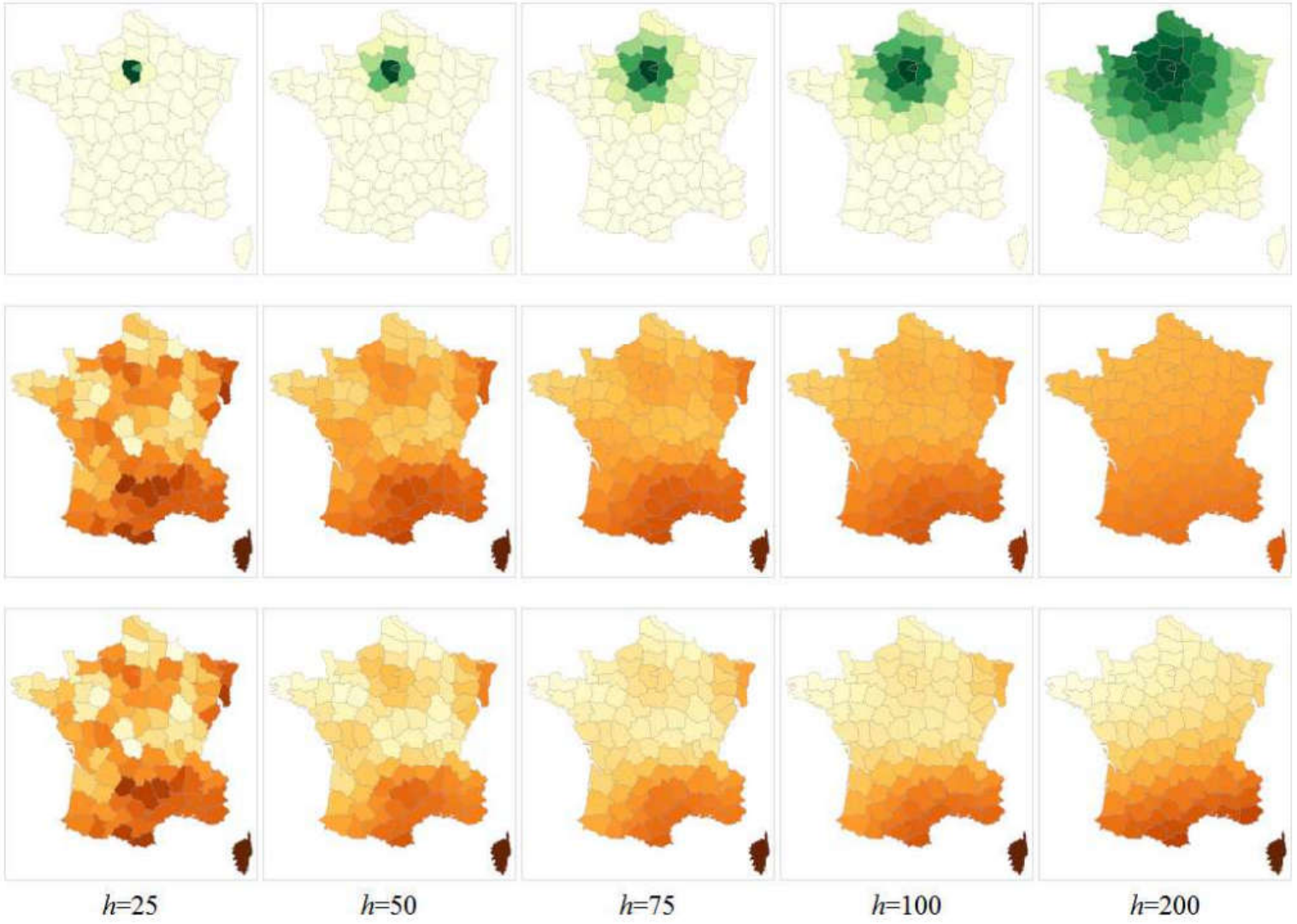
Choropleth



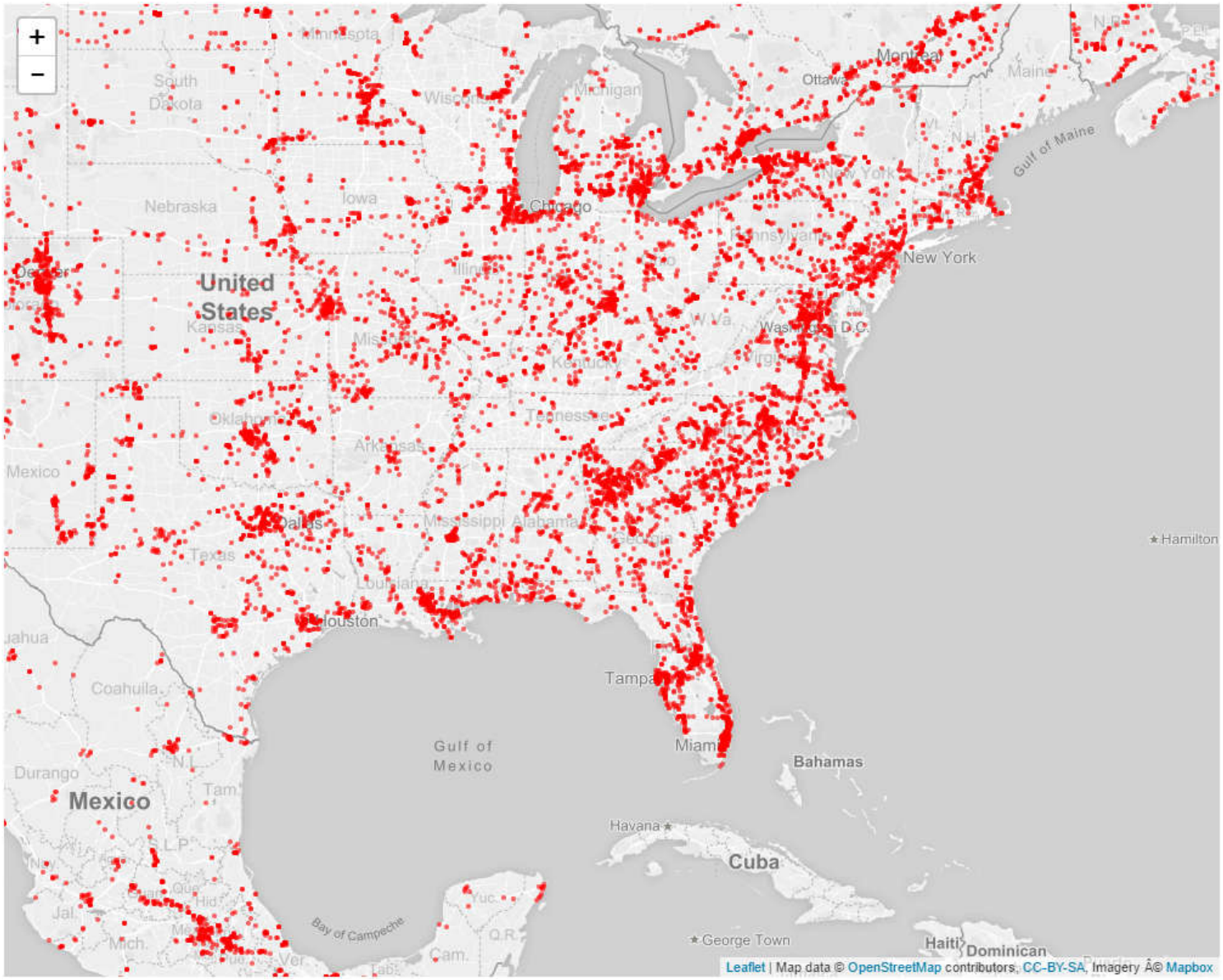
First Choropleth Map by Charles Dupin, 1826. Illiteracy in France.



Friendly, M. (2007). A.-M. Guerry's" Moral Statistics of France": Challenges for Multivariable Spatial Analysis. Statistical Science, 368-399.



Dykes, J., & Brunsdon, C. (2007). Geographically weighted visualization: interactive graphics for scale-varying exploratory analysis. [IEEE TVCG]


United States
Mexico
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Dominican
Chicago
New York
Montreal
Ottawa
Gulf of Maine
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Dallas
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Miami
Havana
George Town
Hamilton
Bay of Campeche
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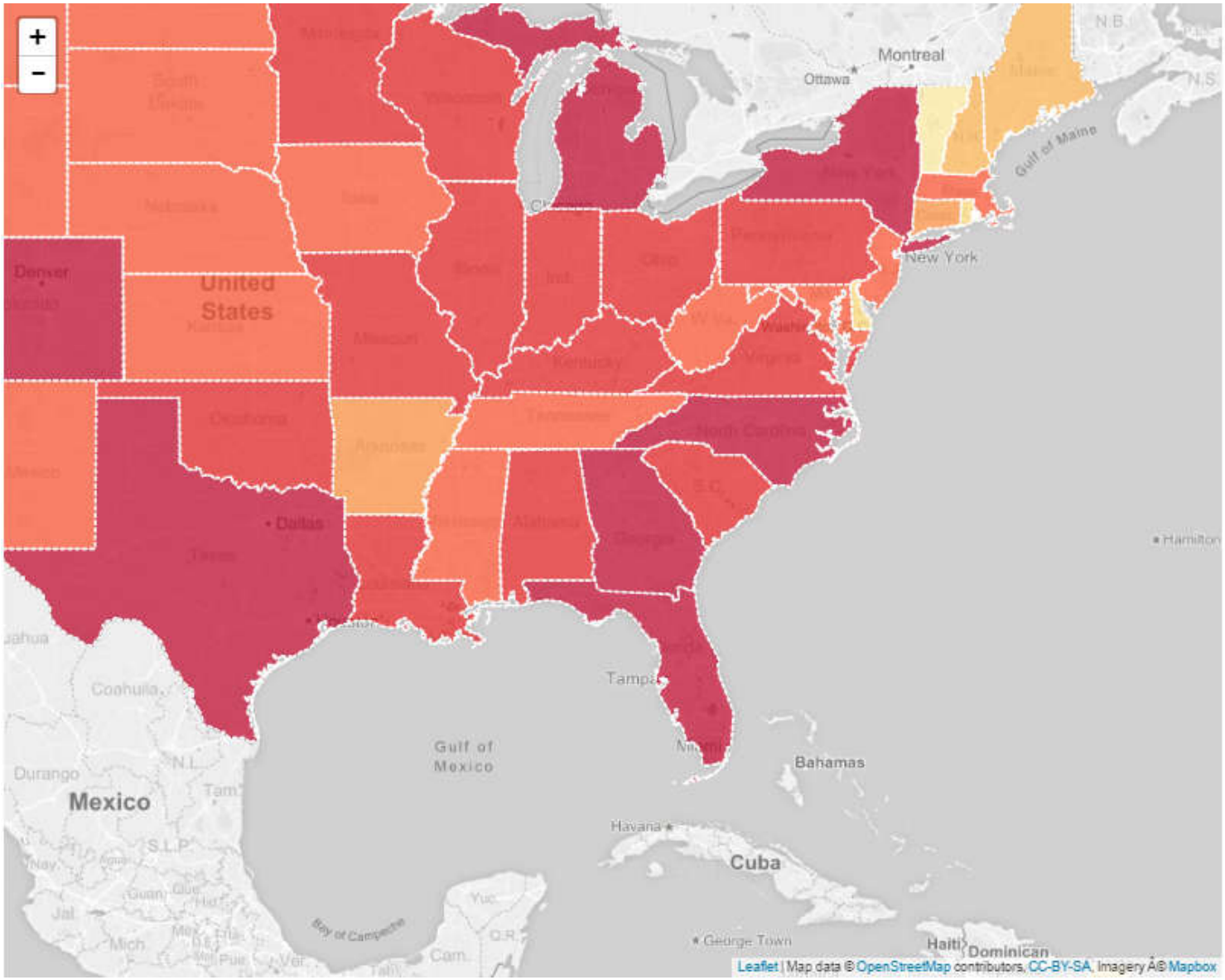
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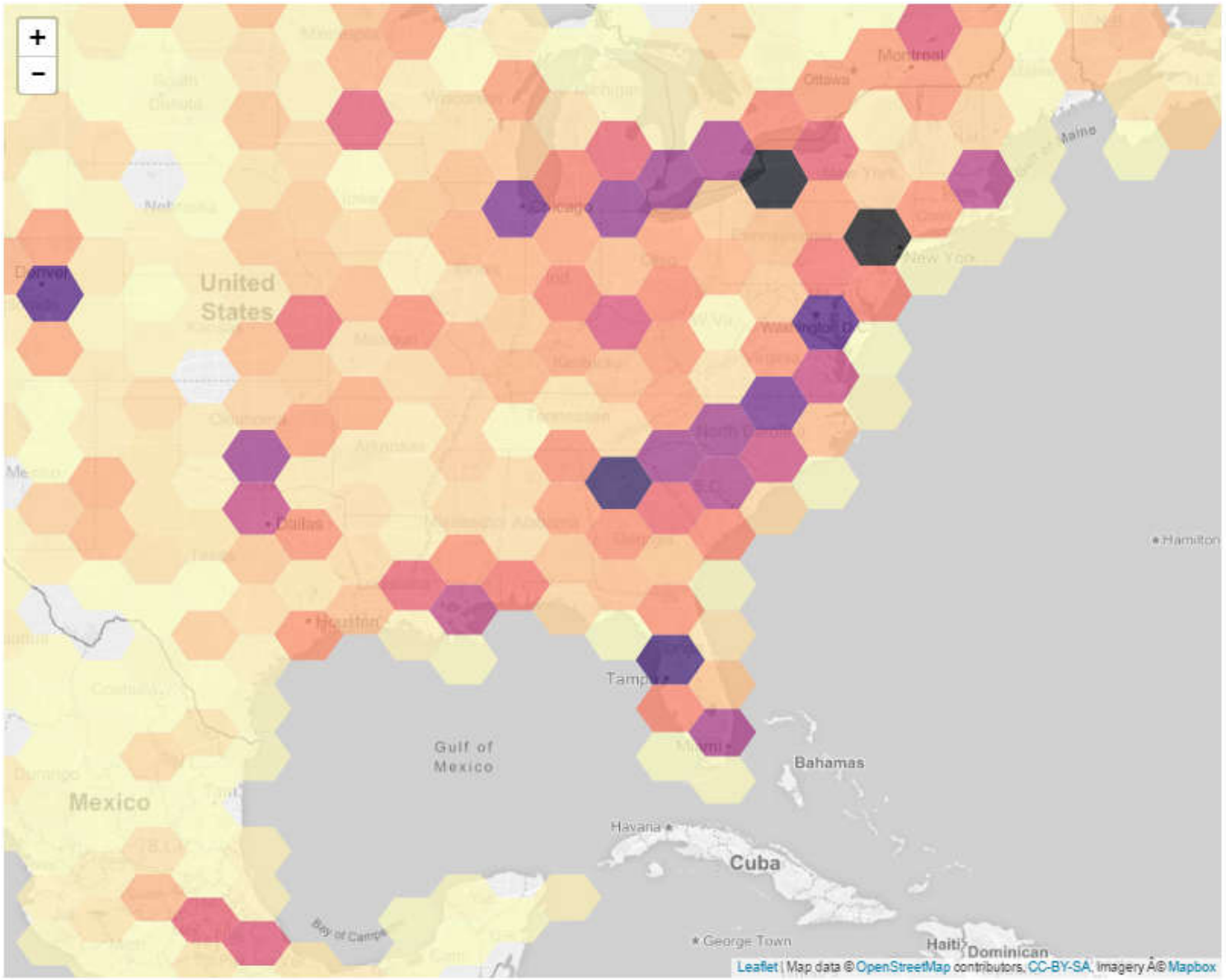
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Tampa
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Dominican
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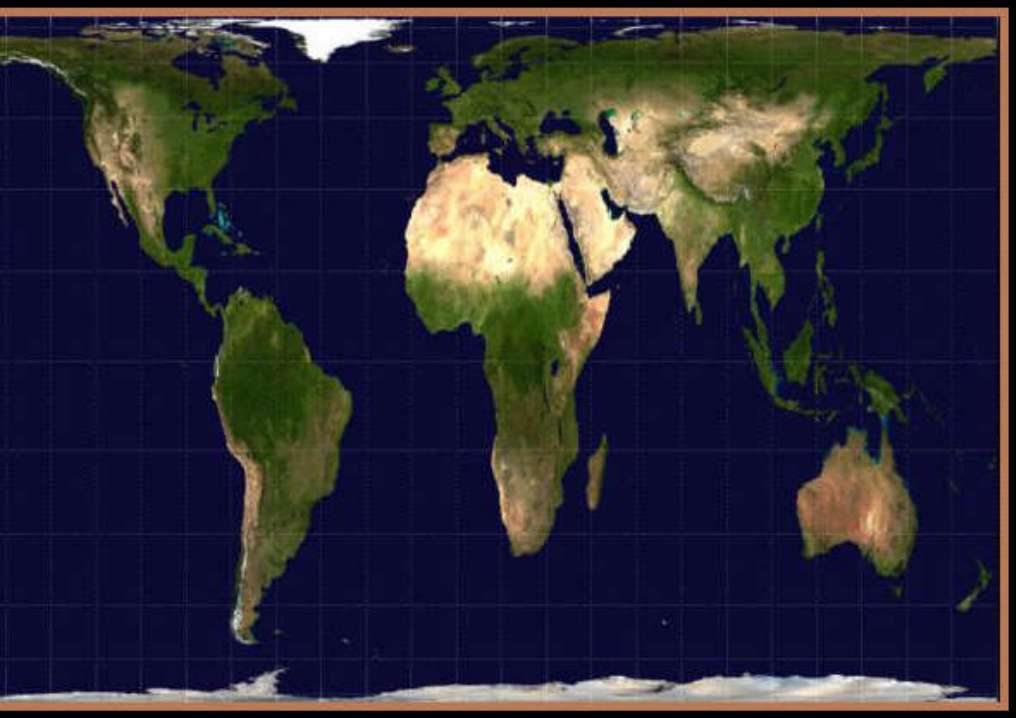
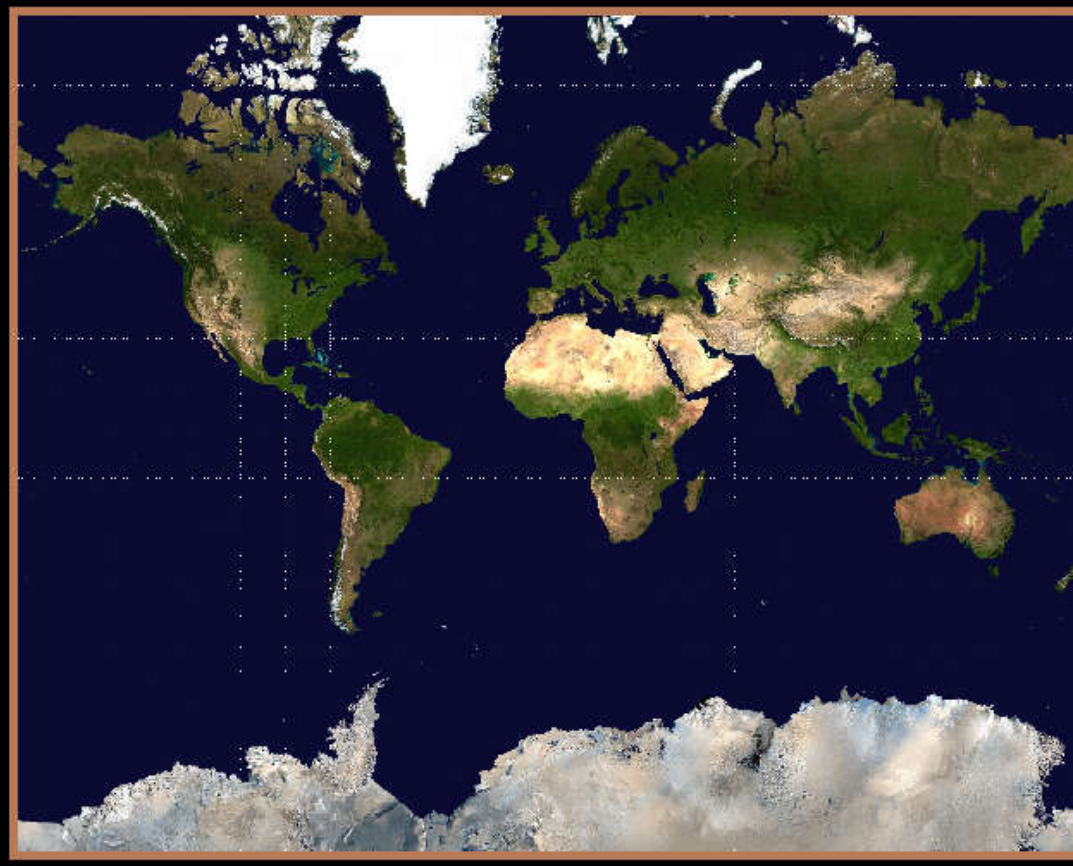
Cartograms

The West Wing, Gall-Peters Projections. [https://www.youtube.com/watch?v=vVX-PrBRtTY]



Peters Projection

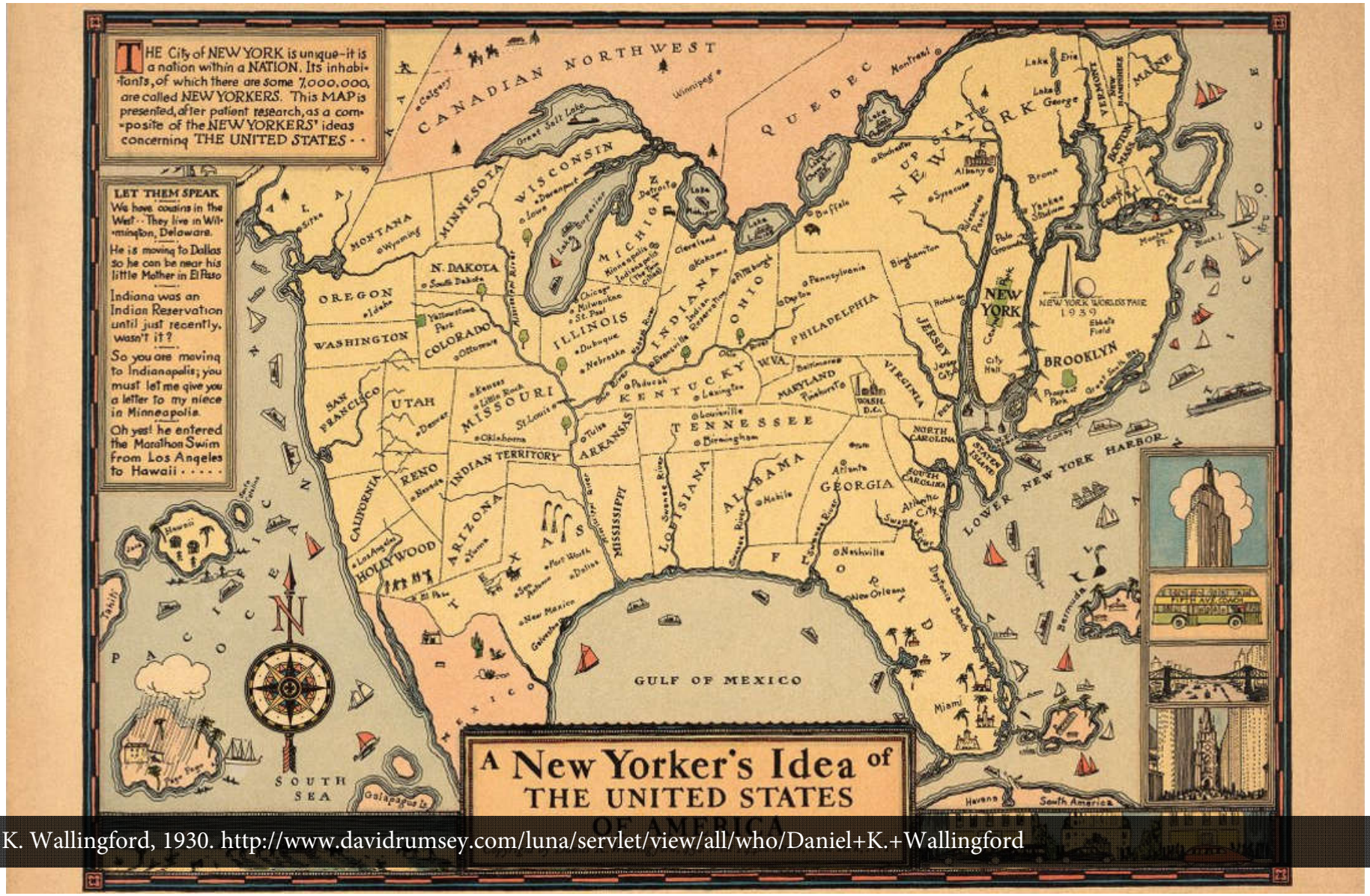
The true representaion of land area
(the "size" of continents and countries)



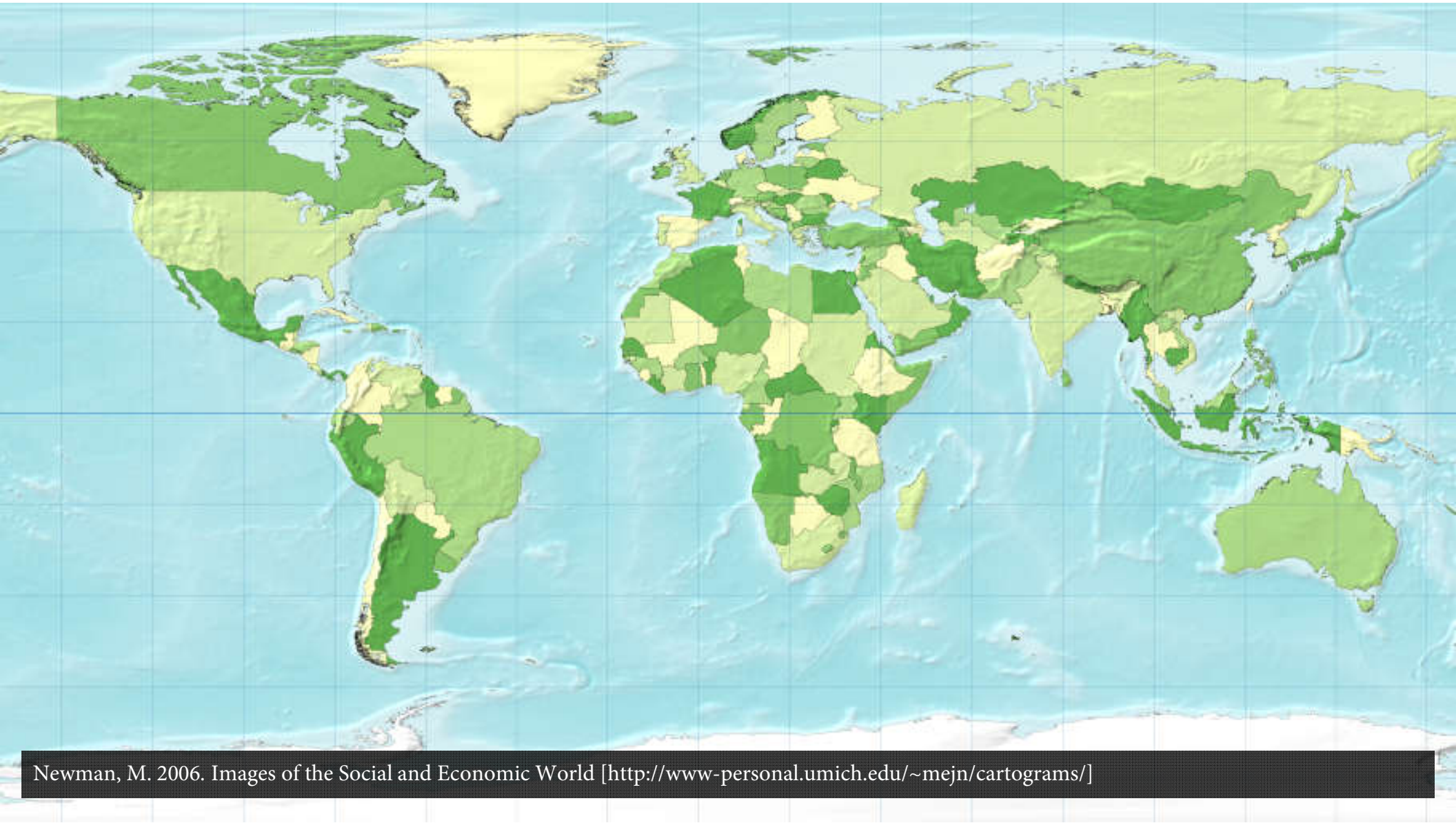
Mercator Projection

Incorrect/false repesentation of land area

Daniel K. Wallingford, 1930. http://www.davidrumsey.com/luna/servlet/view/all/who/Daniel+K.+Wallingford



Daniel K. Wallingford, 1930. http://www.davidrumsey.com/luna/servlet/view/all/who/Daniel+K.+Wallingford



Newman, M. 2006. Images of the Social and Economic World [http://www-personal.umich.edu/~mejn/cartograms/]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CANADA
U.K.
GERMANY
UKRAINE
UNITED STATES
FRANCE
CHINA
ITALY
TURKEY
IRAN
PAKISTAN
S. KOREA
JAPAN
MEXICO
EGYPT
INDIA
BANGLADESH
NIGERIA
MYANMAR
PHILIPPINES
ETHIOPIA
THAILAND
COLOMBIA
PACIFIC OCEAN
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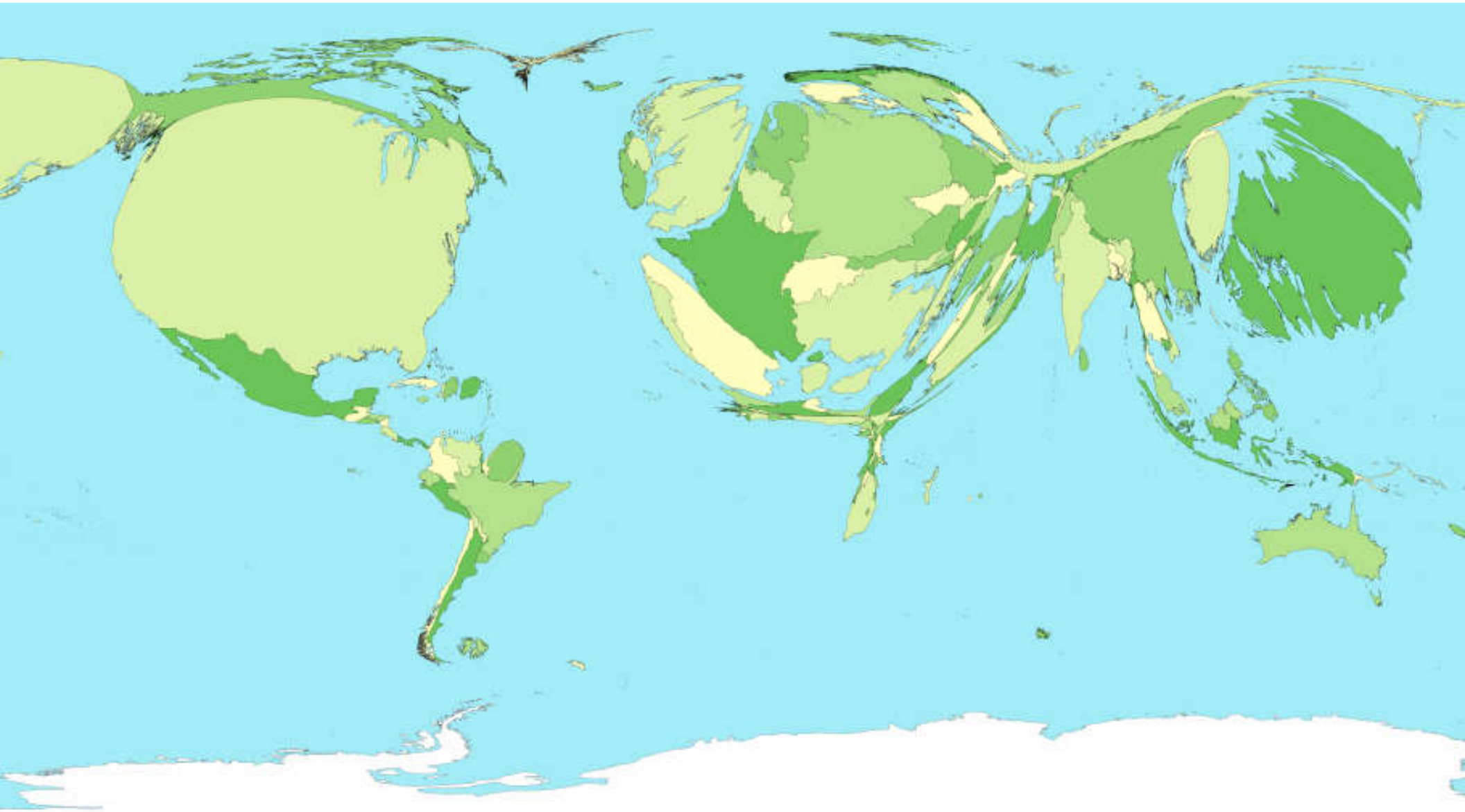
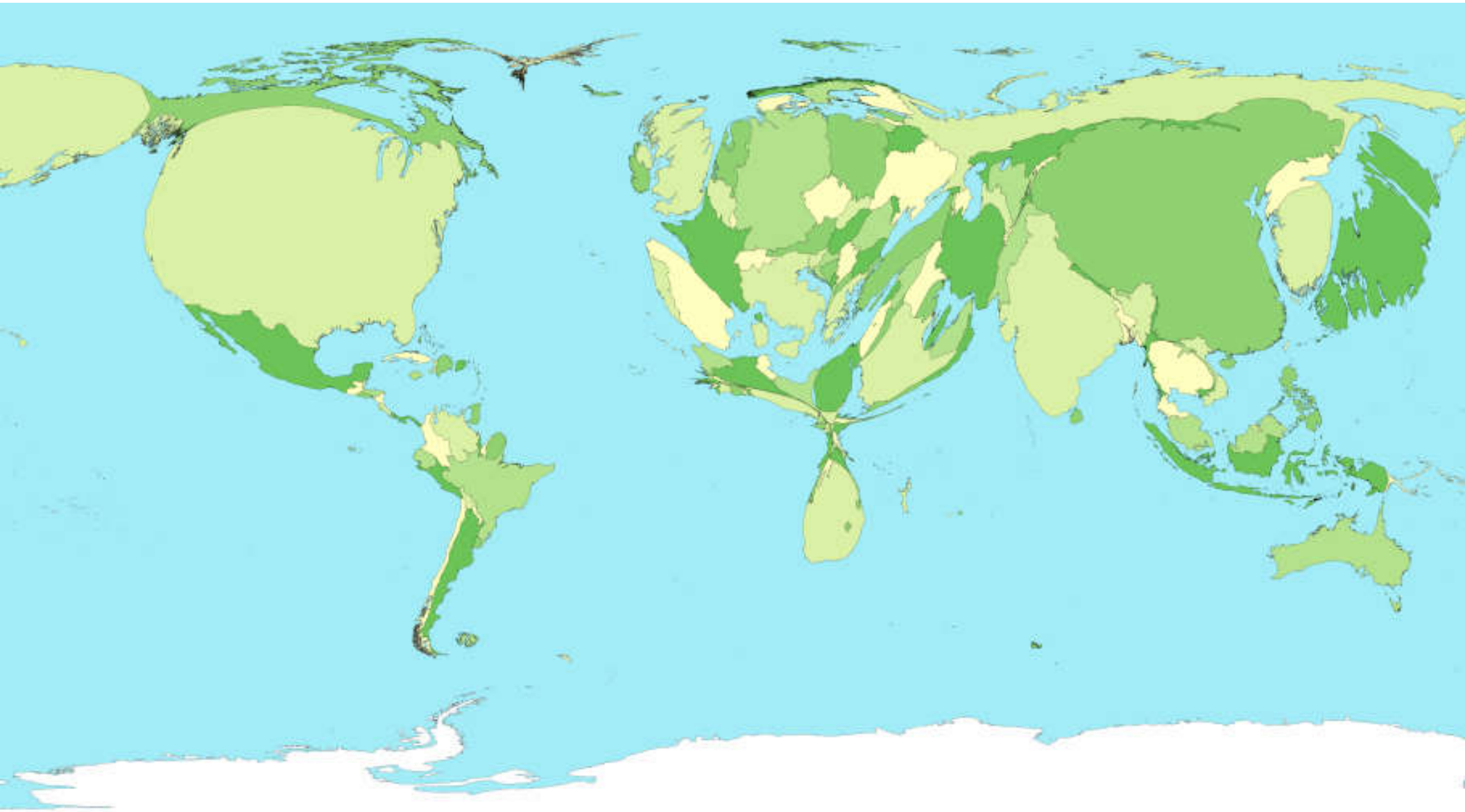
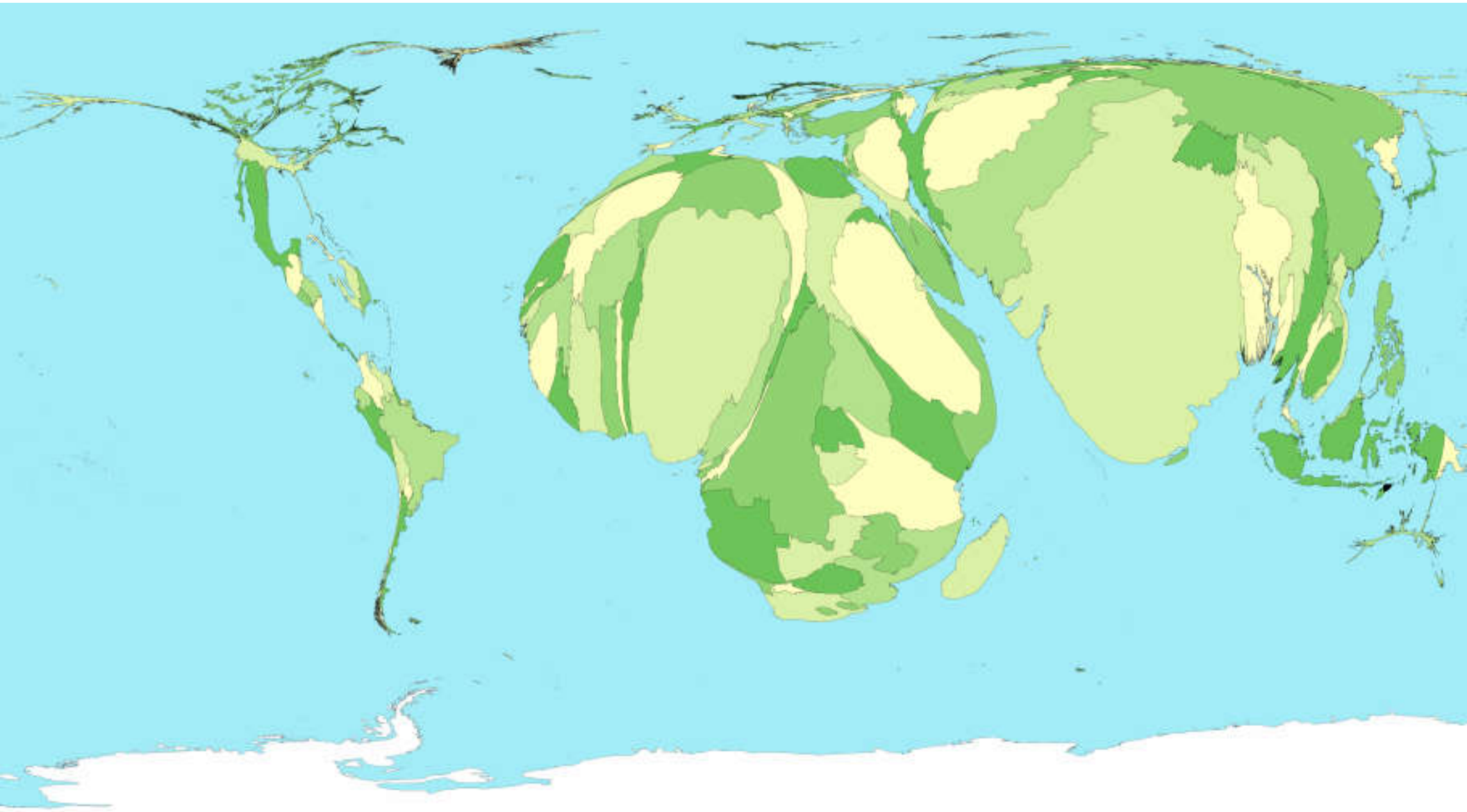
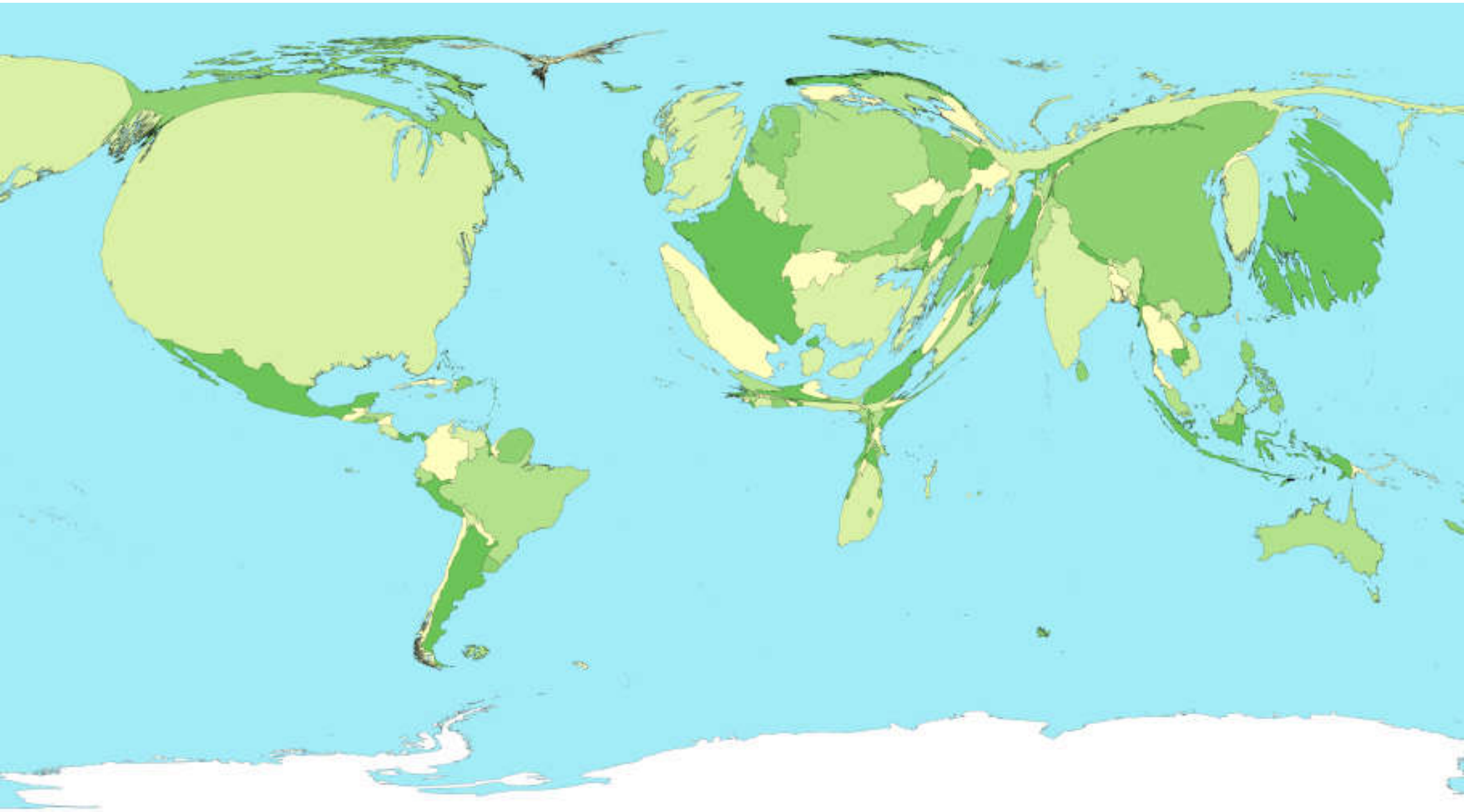
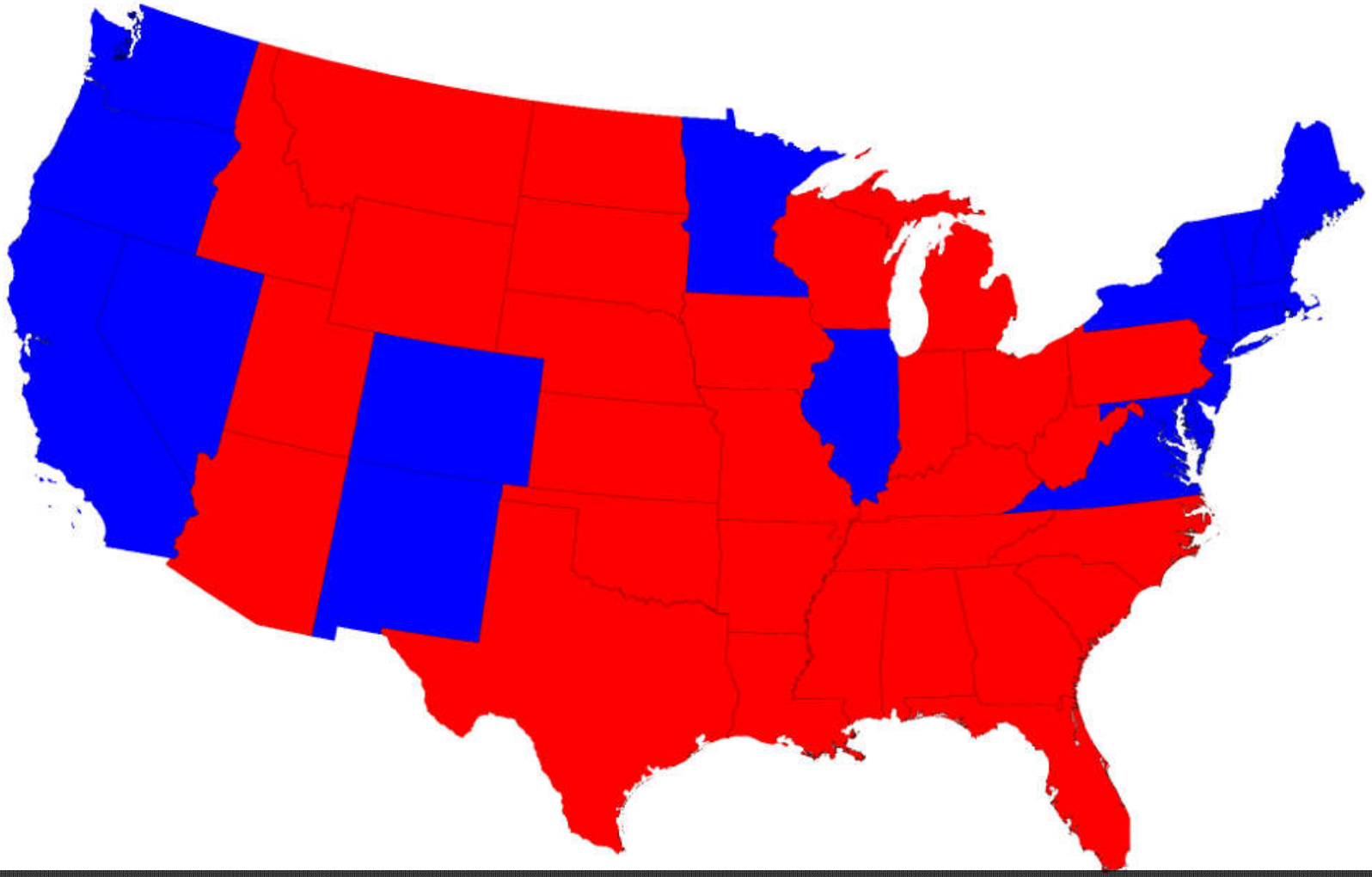


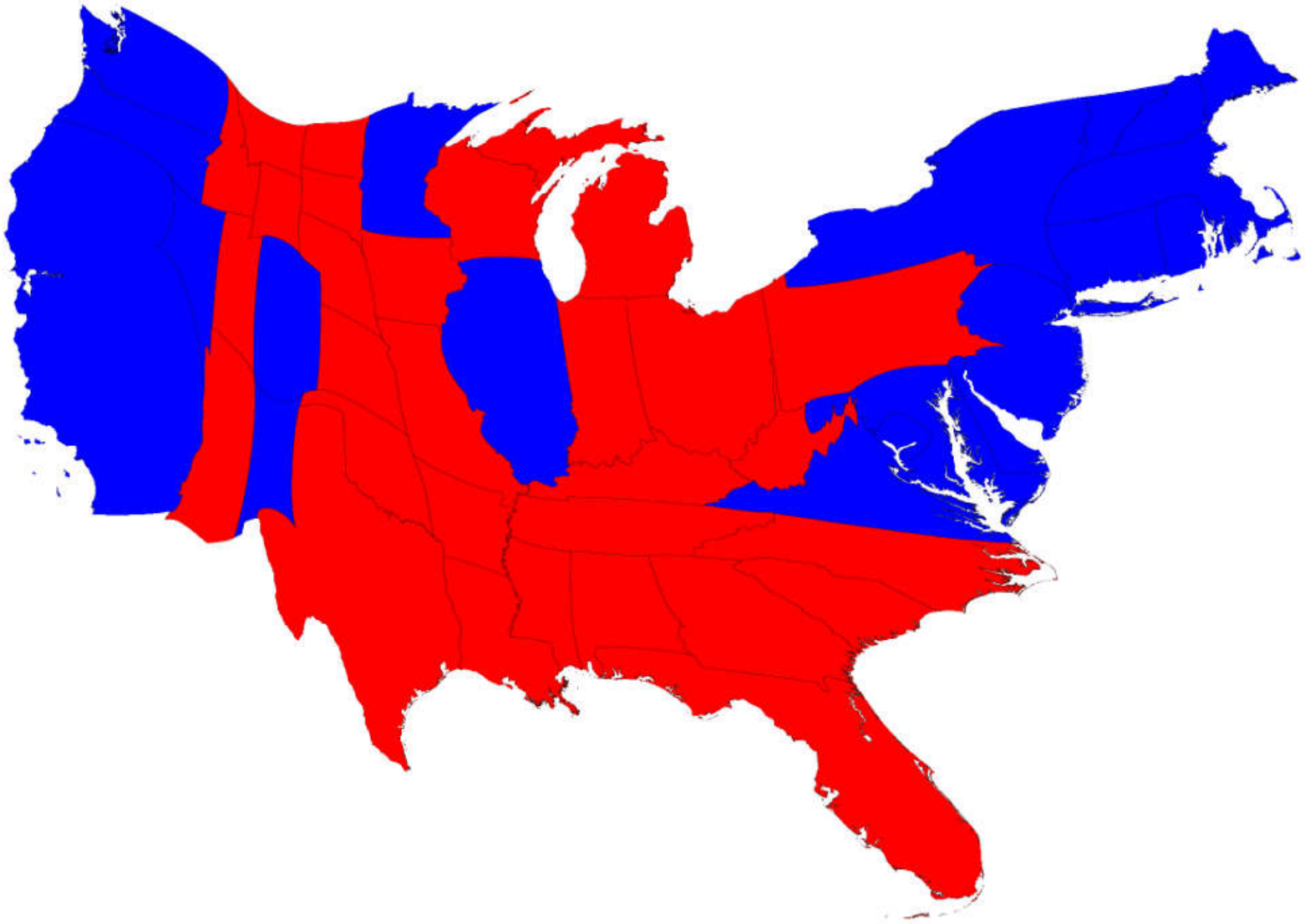


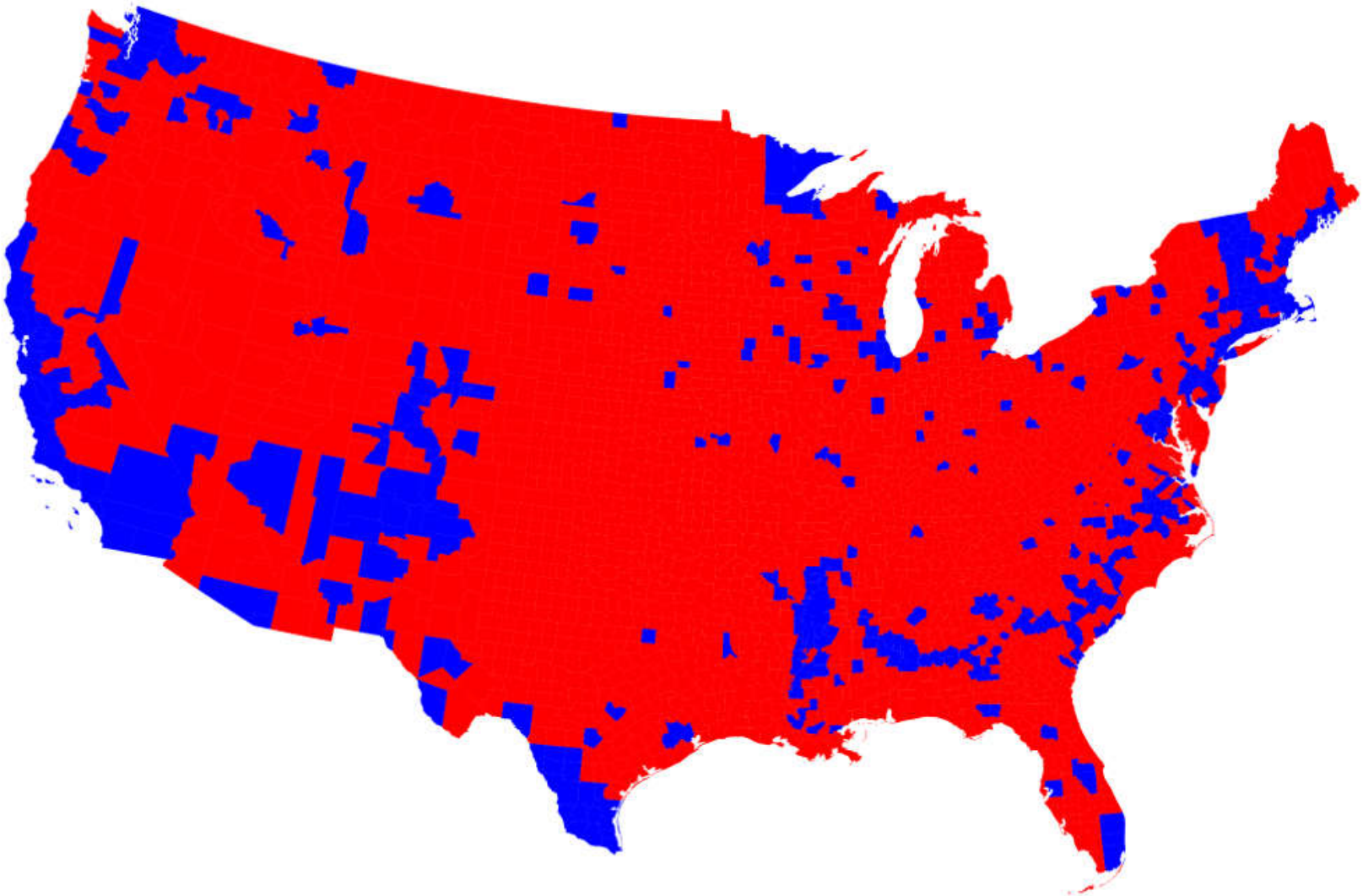


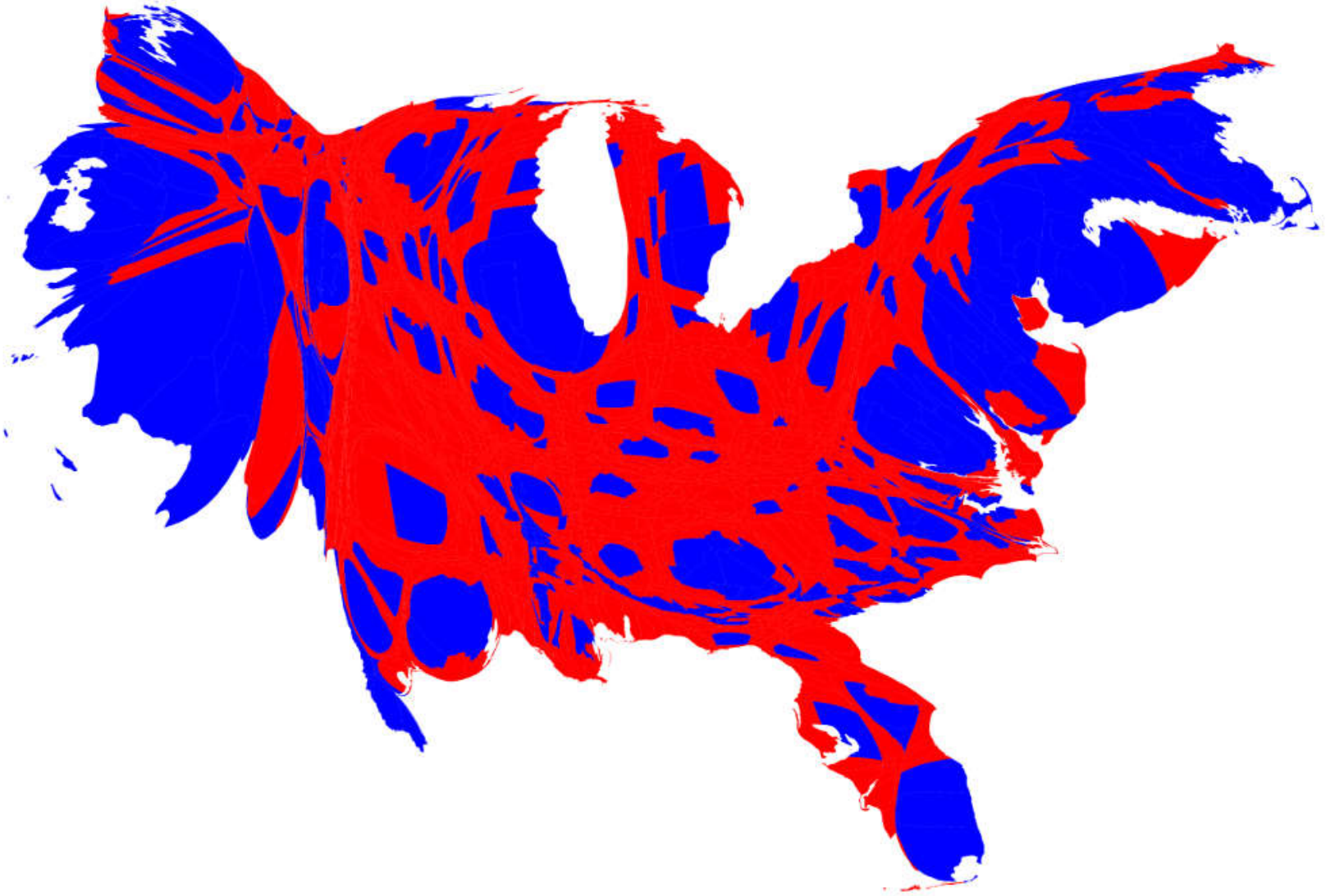


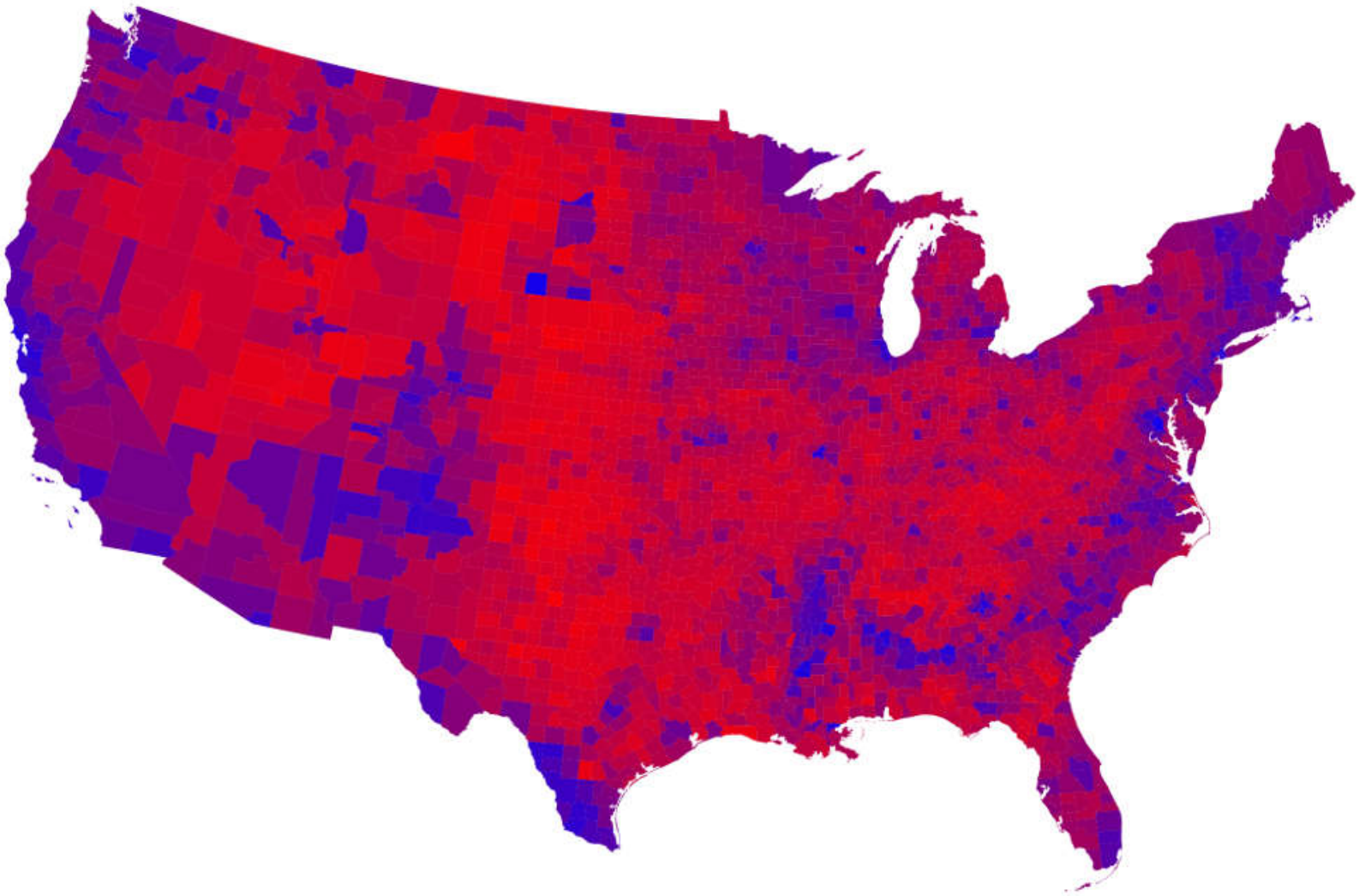


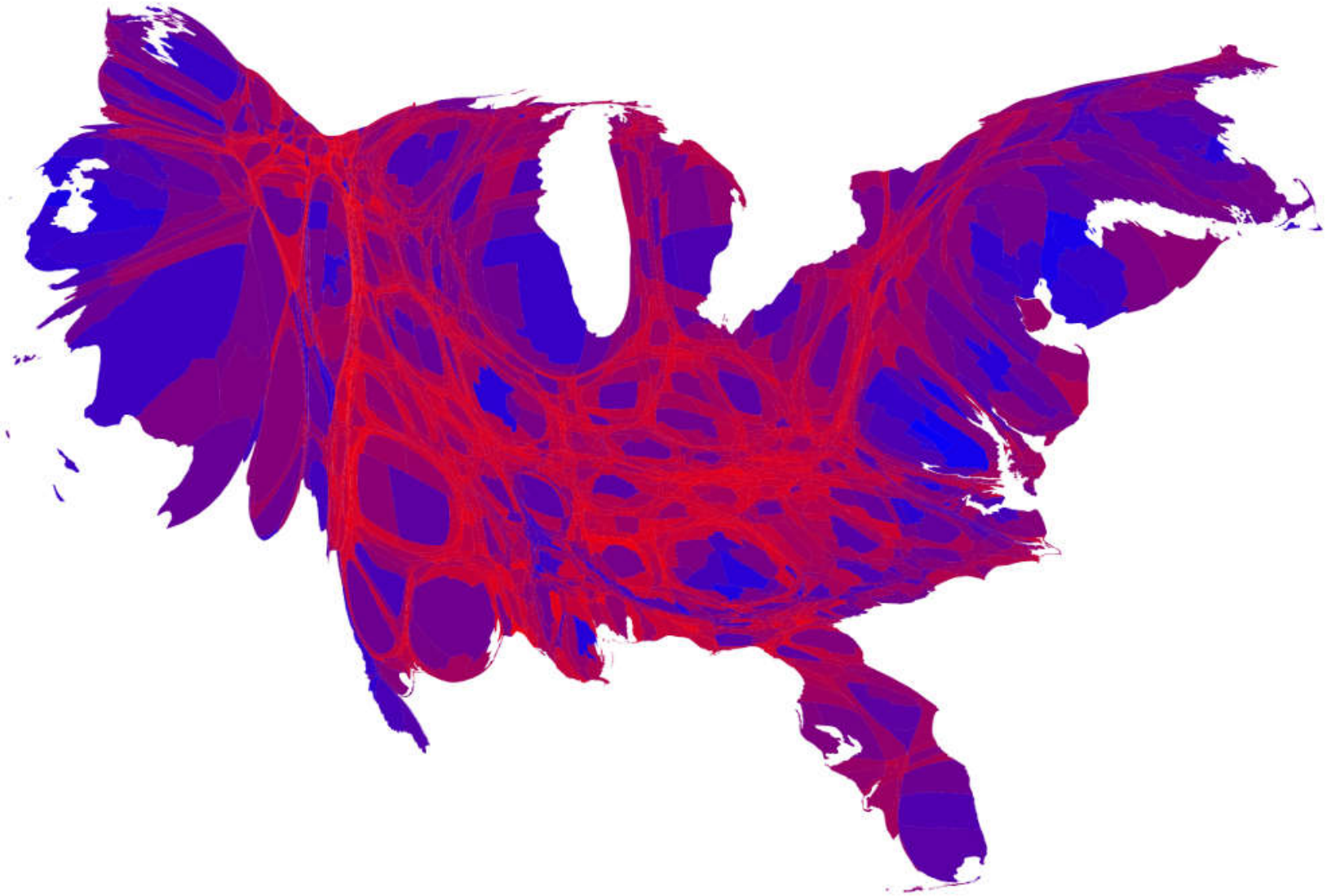
Newman, M. 2016. Maps of the 2016 US Presidential Election Results. http://www-personal.umich.edu/~mejn/election/2016/

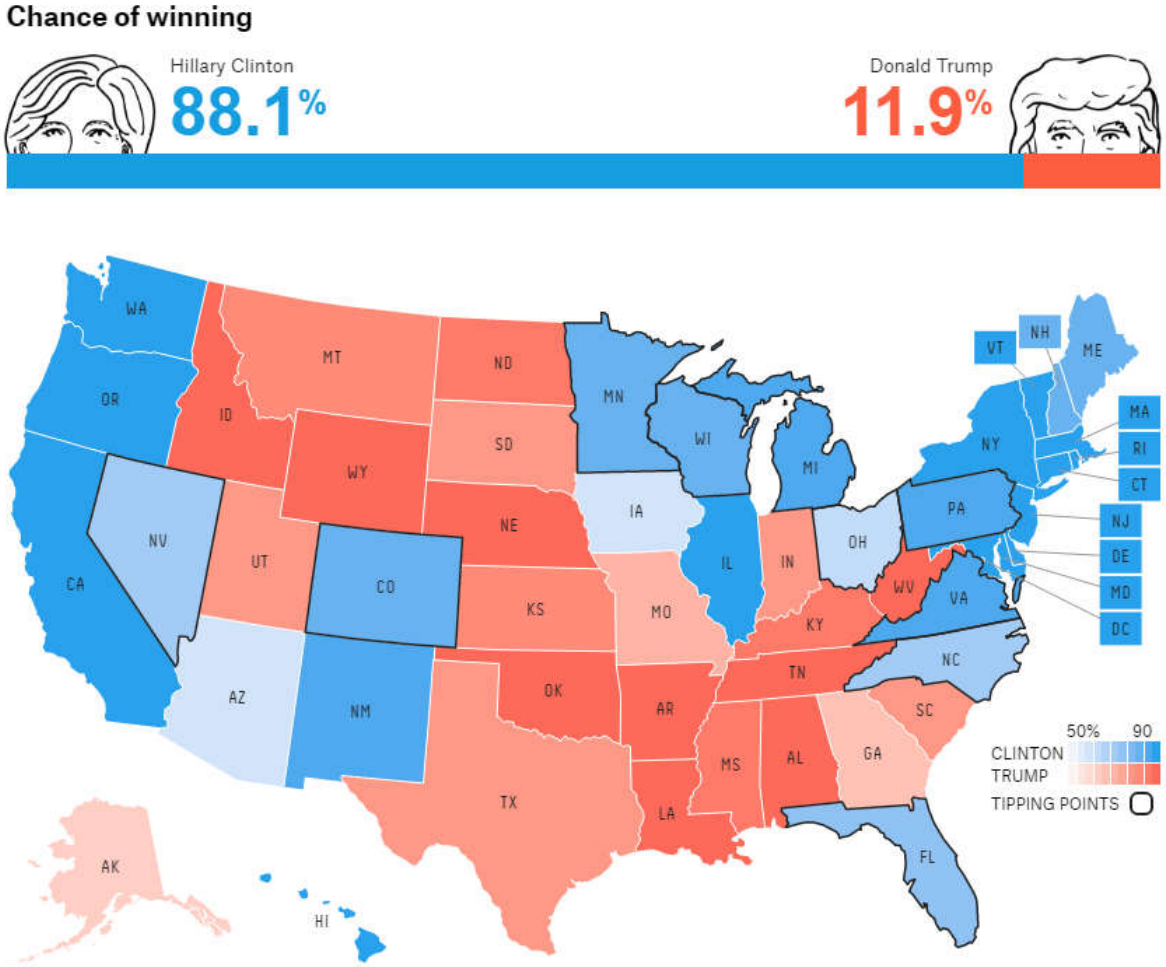




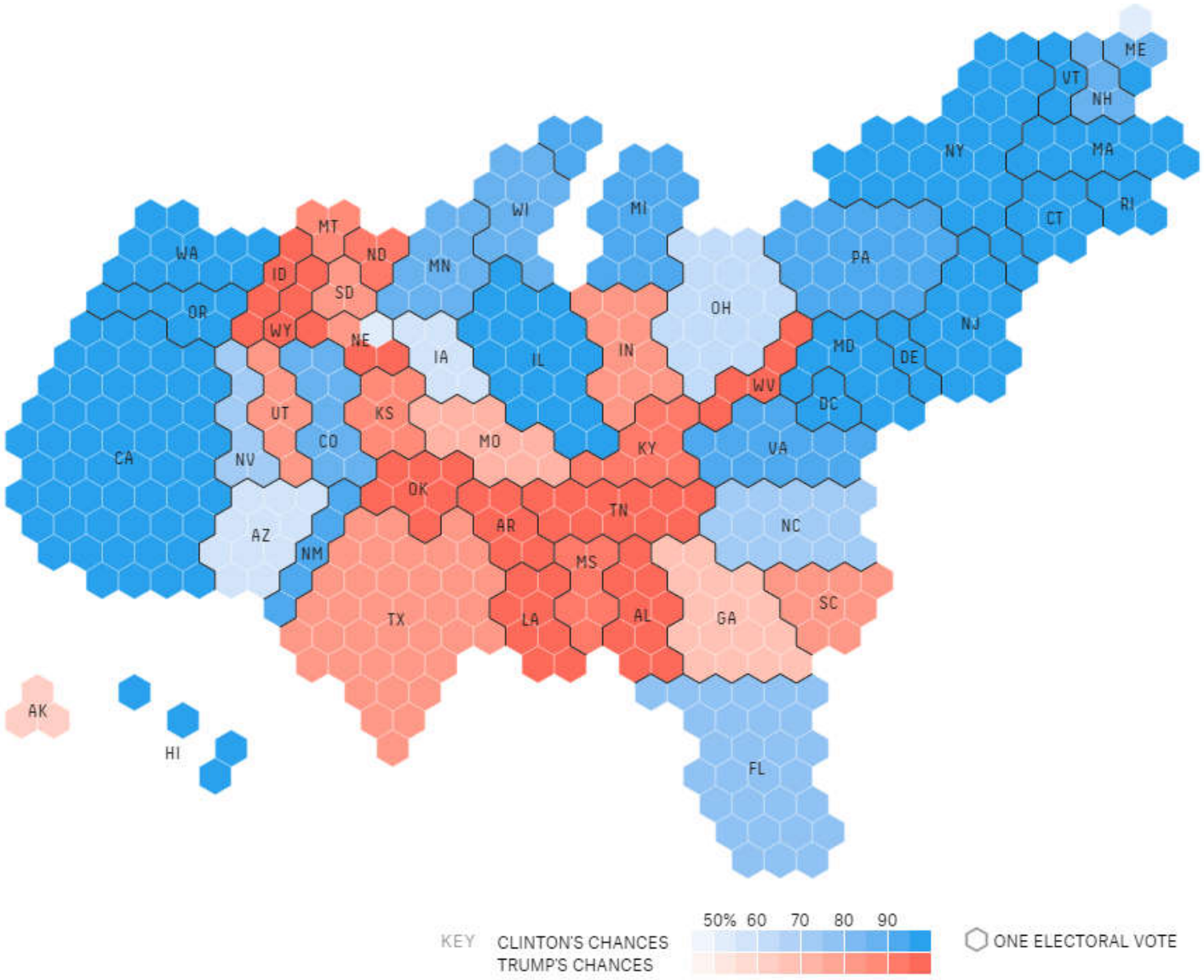








Five Thirty Eight. 2016. https://projects.fivethirtyeight.com/2016-election-forecast/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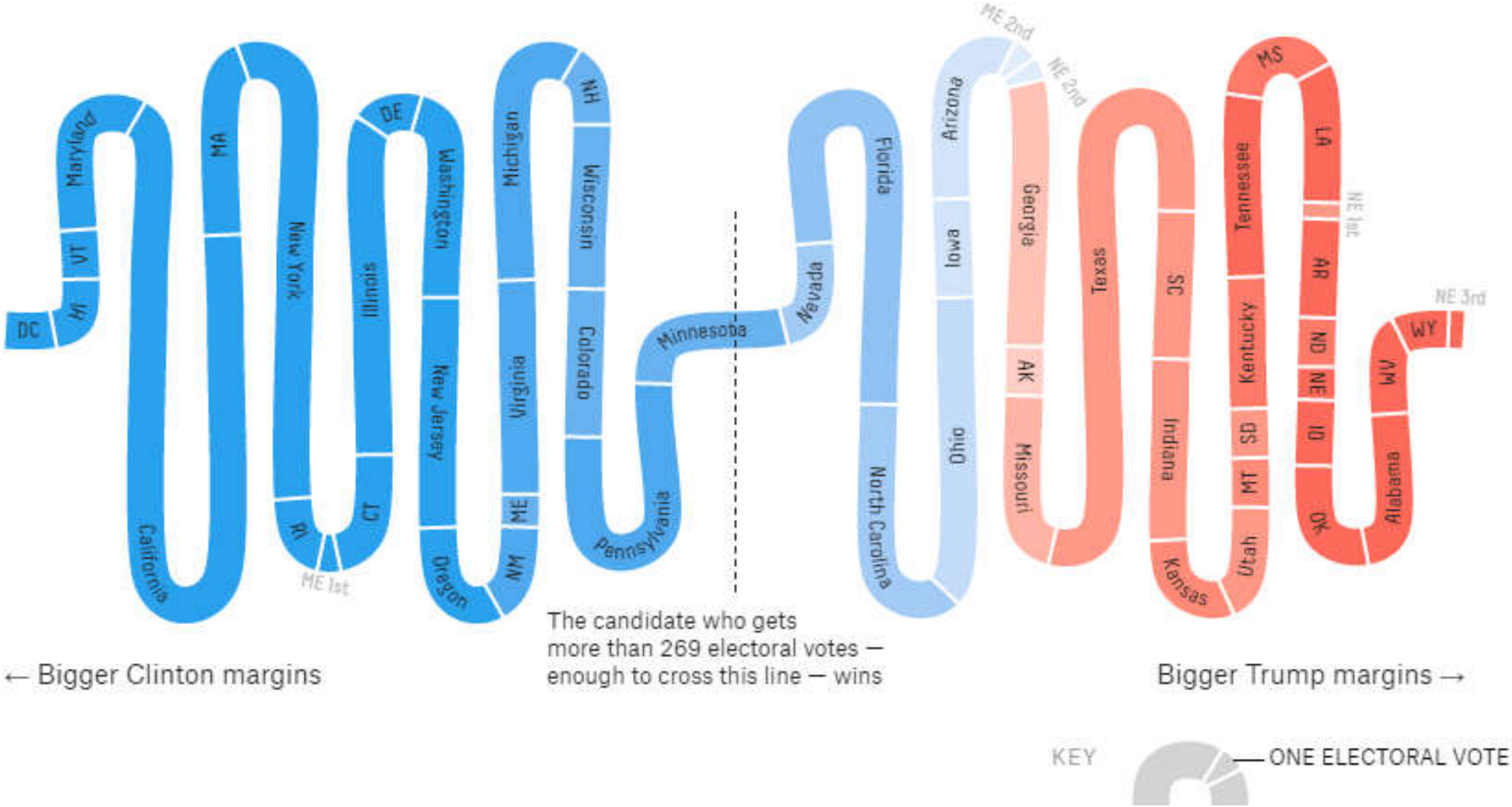
TRUMP'S CHANCES
50%
60
70
80
90
ONE ELECTORAL VOTE

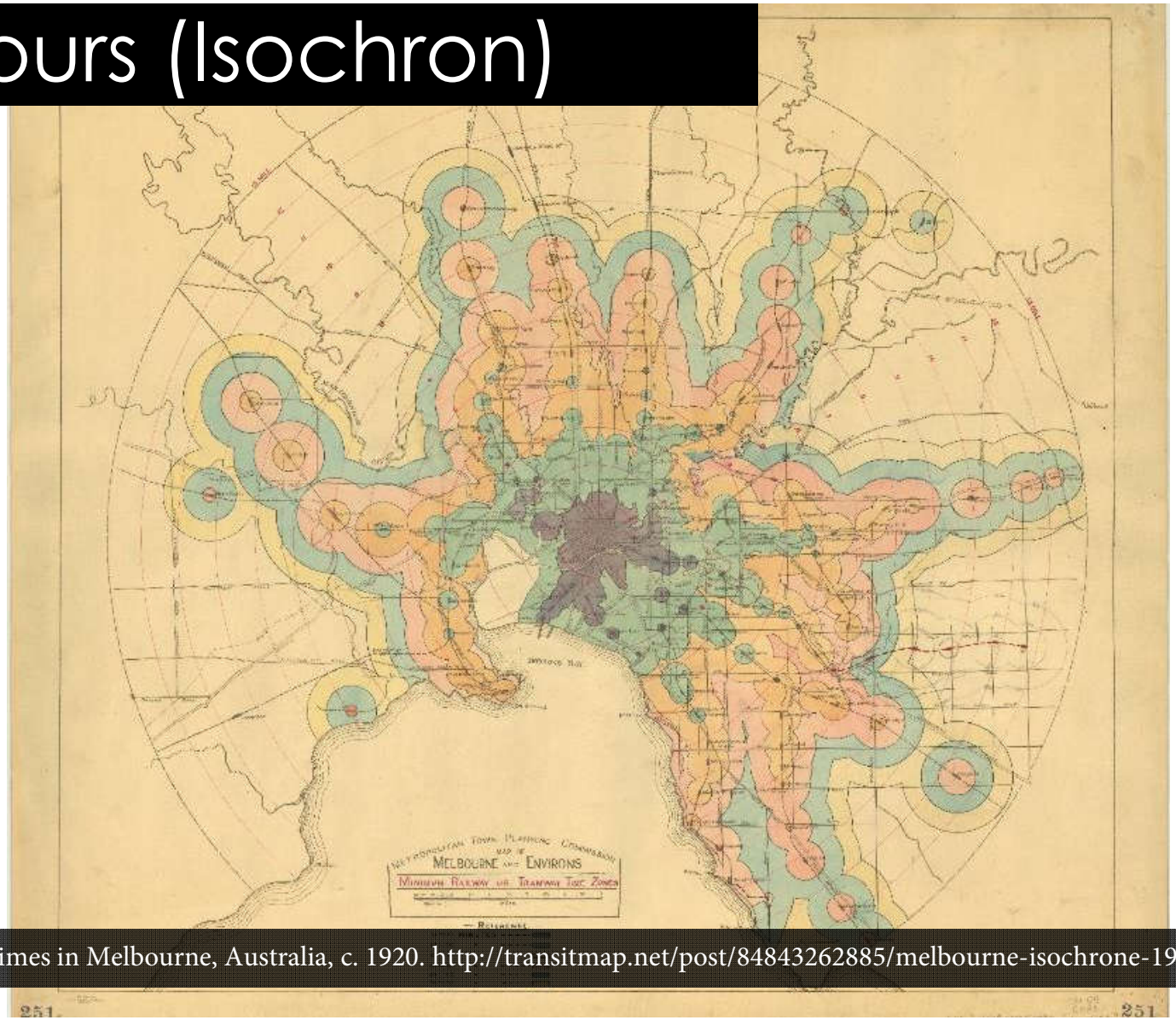

DC
HI
VT
Maryland
California
MA
New York
RI
ME 1st
CT
Illinois
DE
New Jersey
Washington
Oregon
ME
NH
Wisconsin
Michigan
Virginia
Colorado
Pennsylvania
Minnesota
Nevada
Florida
North Carolina
Ohio
Iowa
Arizona
ME 2nd
ME 2nd
Georgia
AK
Missouri
Texas
SC
Indiana
Kansas
MT
Utah
SD
Kentucky
Tennessee
MS
LA
ME 1st
AR
ND
NE
ID
OK
Alabama
WV
NE 3rd
WY
The candidate who gets more than 269 electoral votes — enough to cross this line — wins
← Bigger Clinton margins
Bigger Trump margins →
KEY
ONE ELECTORAL VOTE

Wood, J., & Dykes, J. (2008). Spatially ordered treemaps. [IEEE TVCG]

Scalar Fields & Isolines

Isocontours (Terrain)

Isocontours (Isochron)



Train and Tram Travel Times in Melbourne, Australia, c. 1920. http://transitmap.net/post/84843262885/melbourne-isochrone-1920

Desirability Map - California

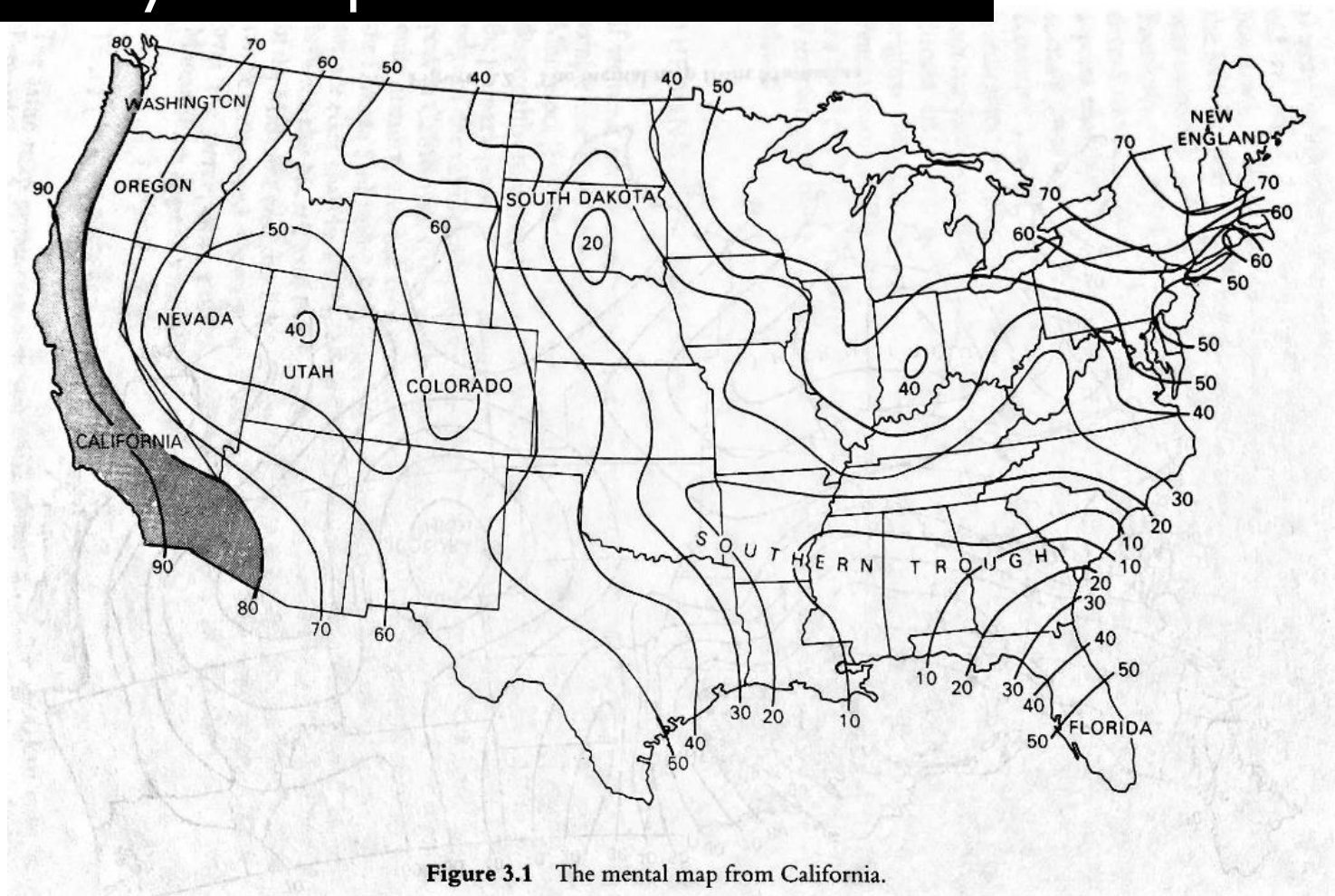
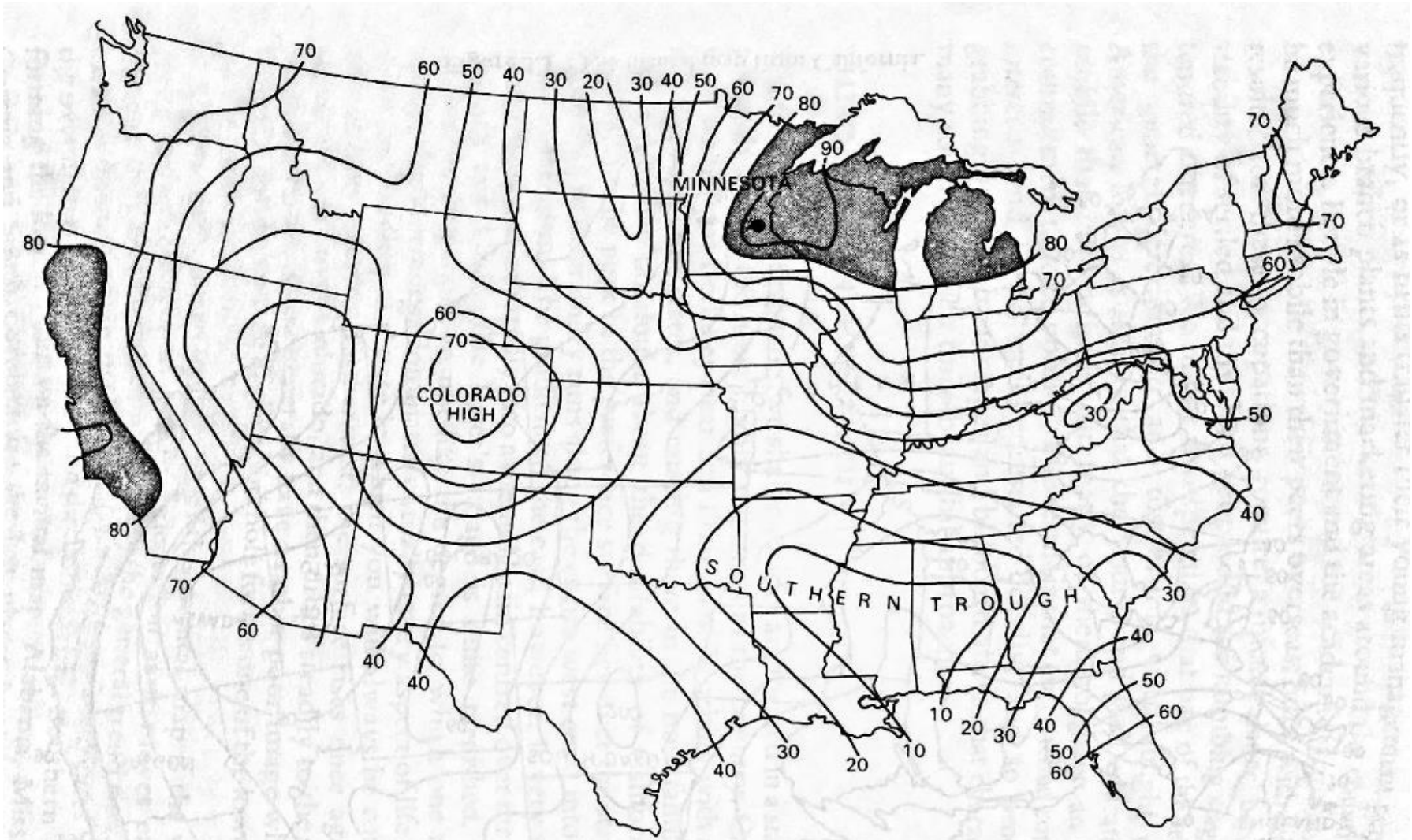
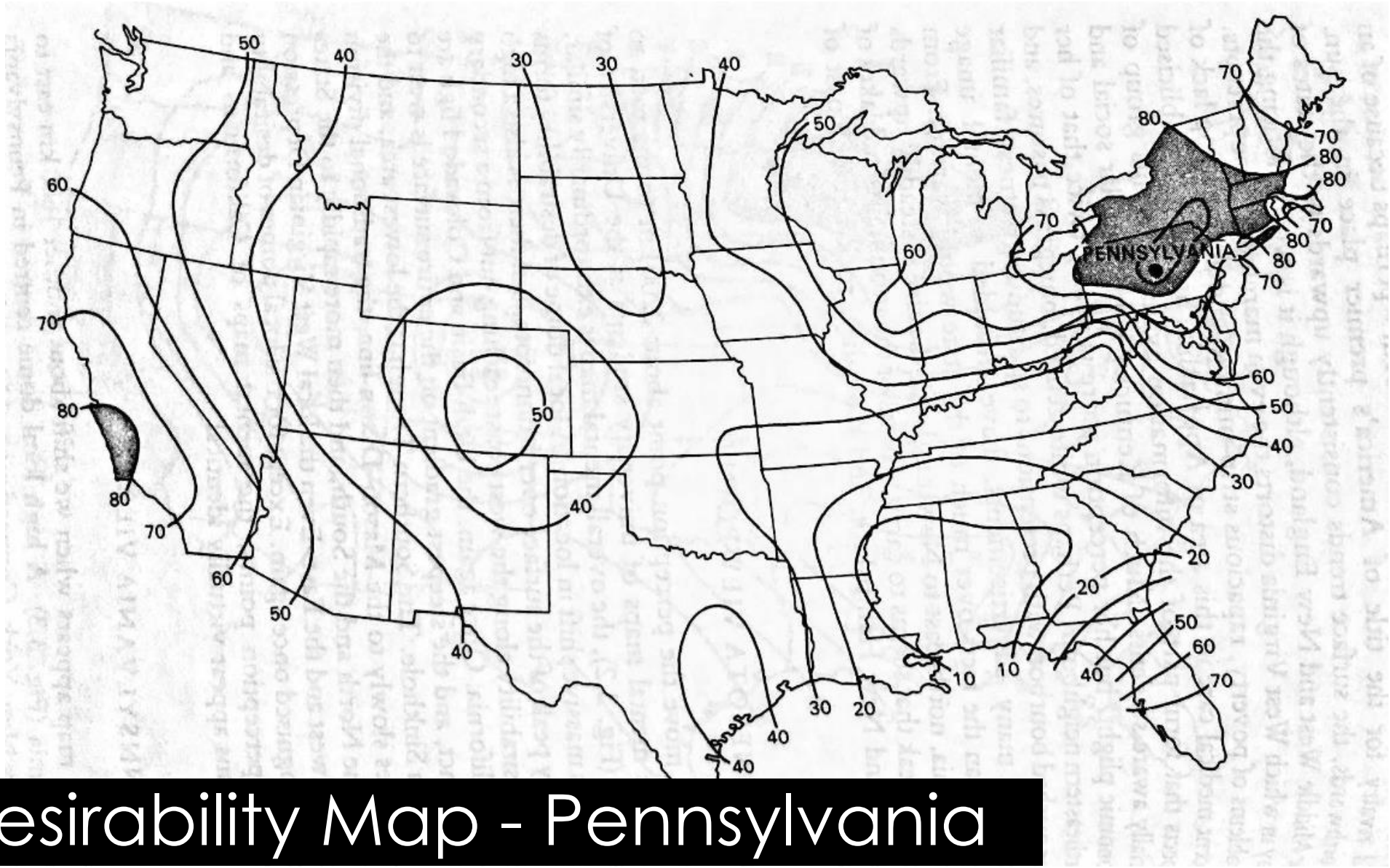


Figure 3.1 The mental map from California.

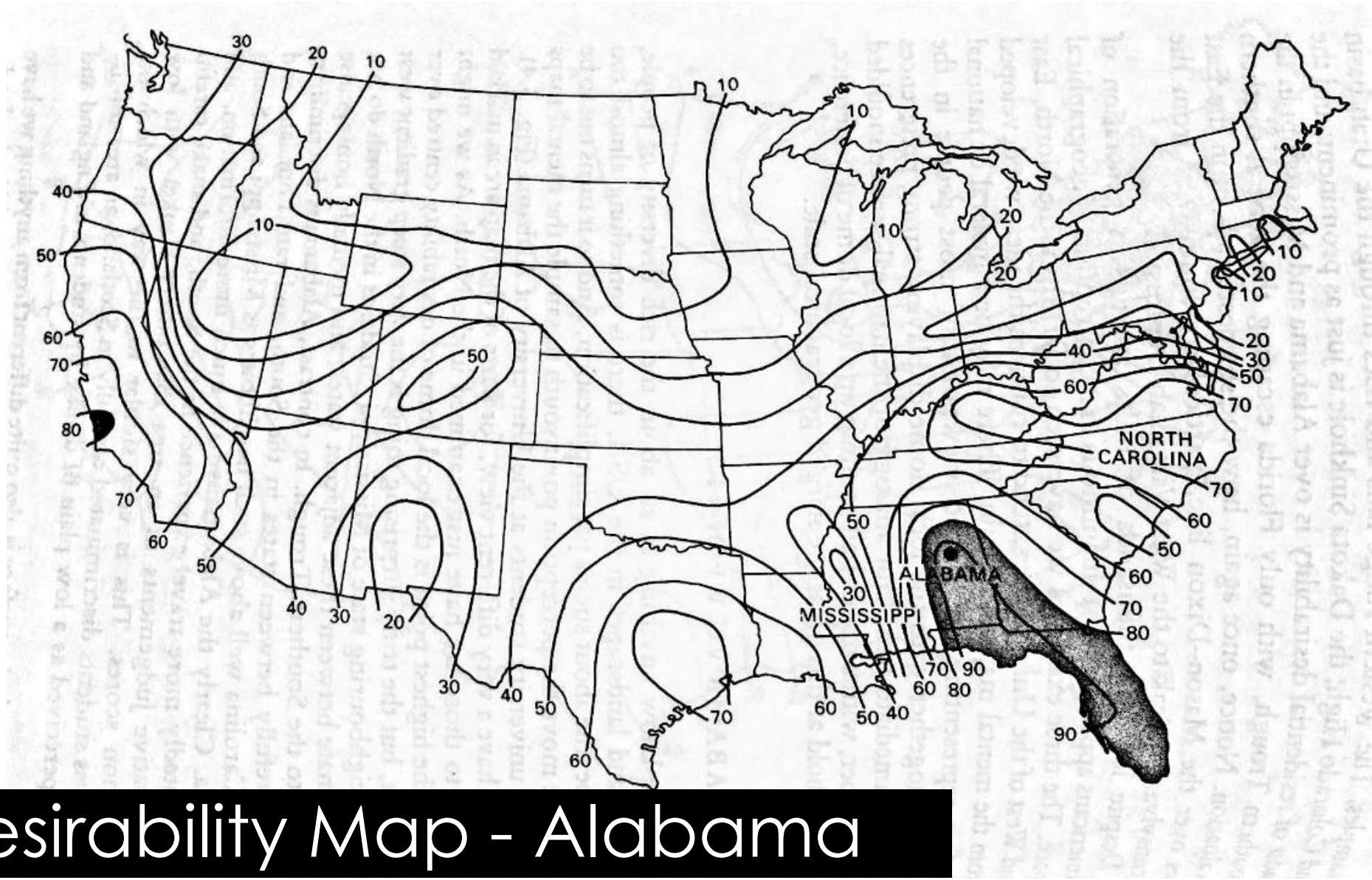
Gould, P., & White, R. (2012). Mental maps. Routledge.



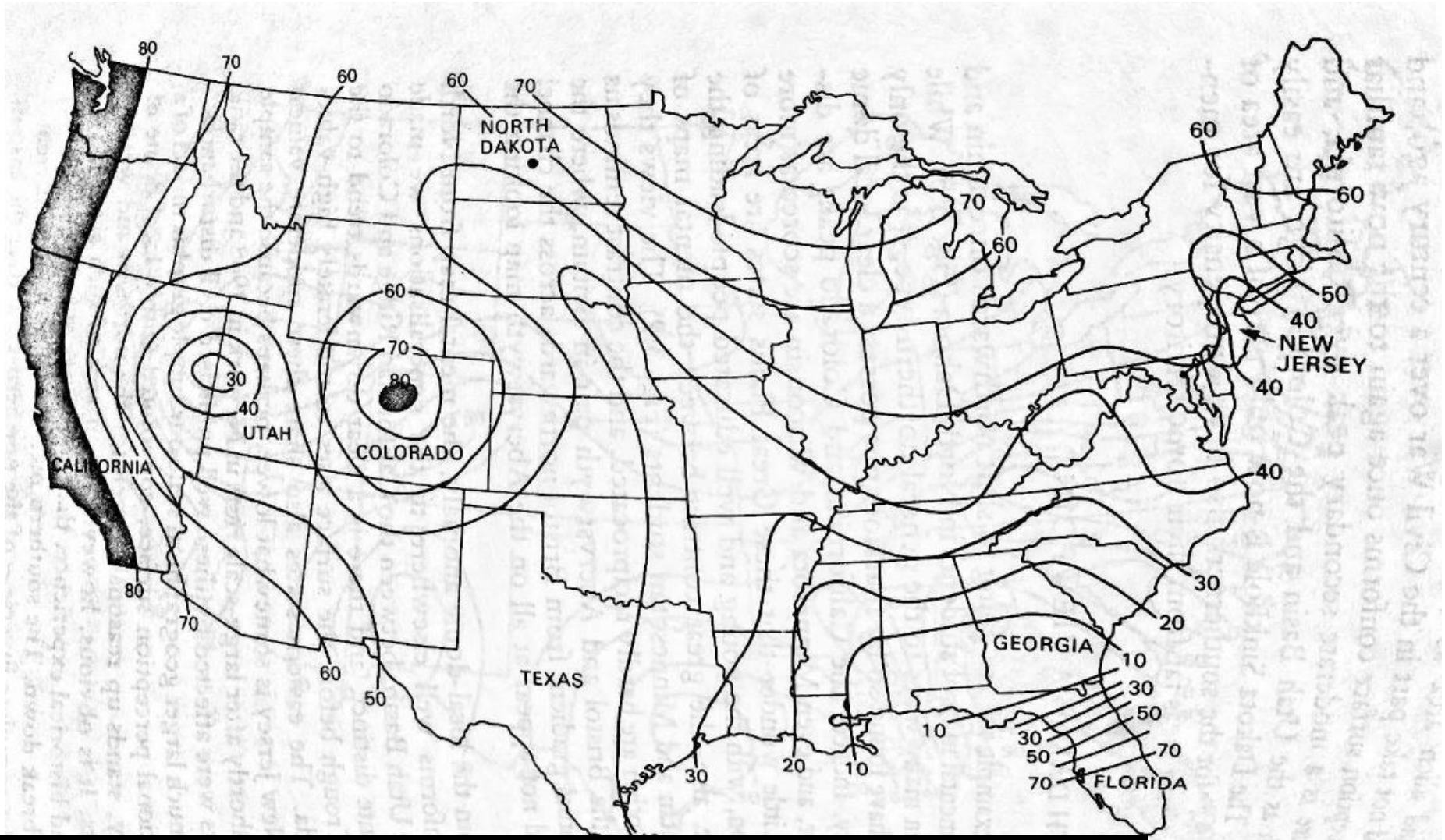
Desirability Map - Minnesota



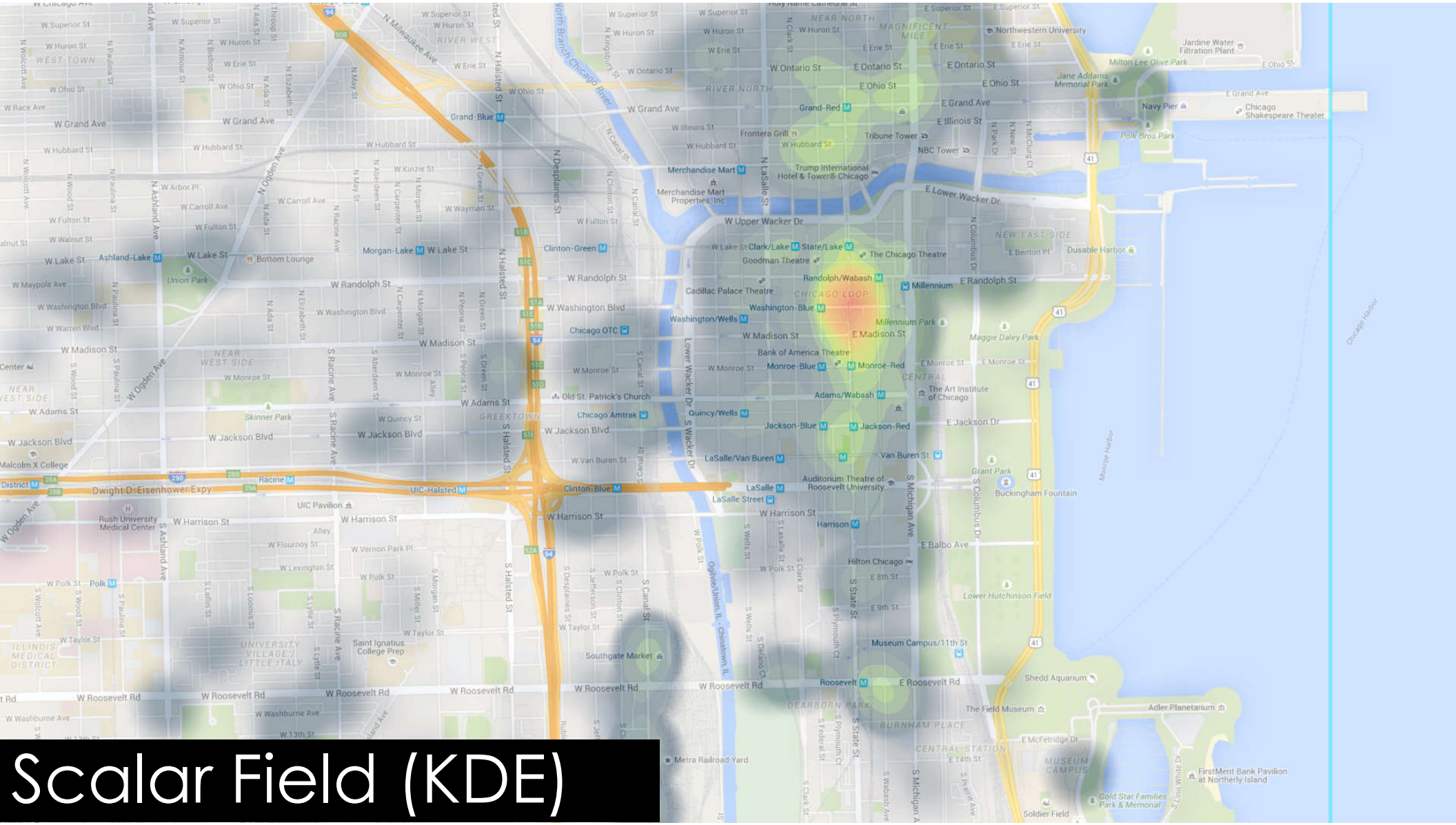
Desirability Map - Pennsylvania



Desirability Map - Alabama

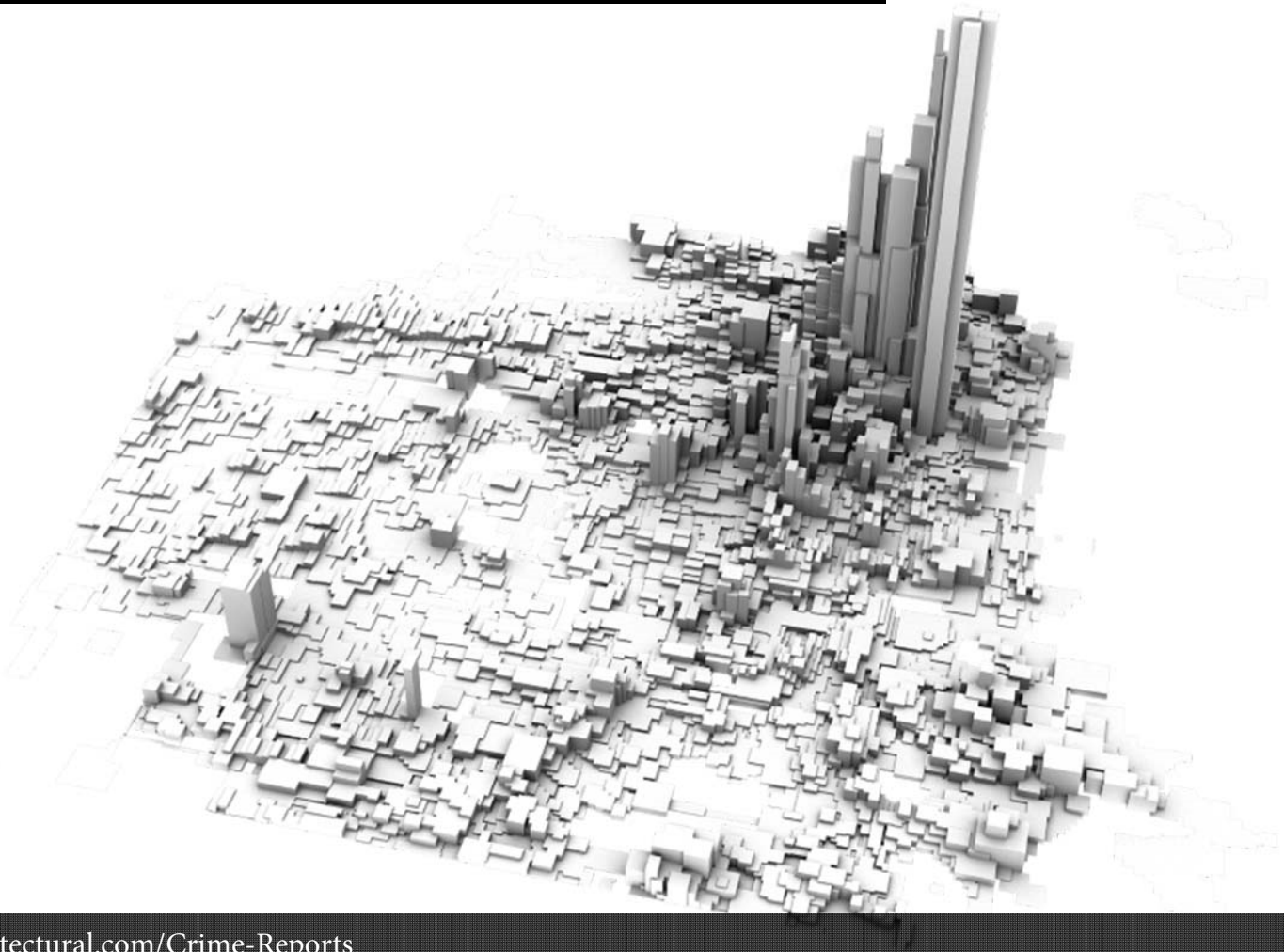


Desirability Map – North Dakota

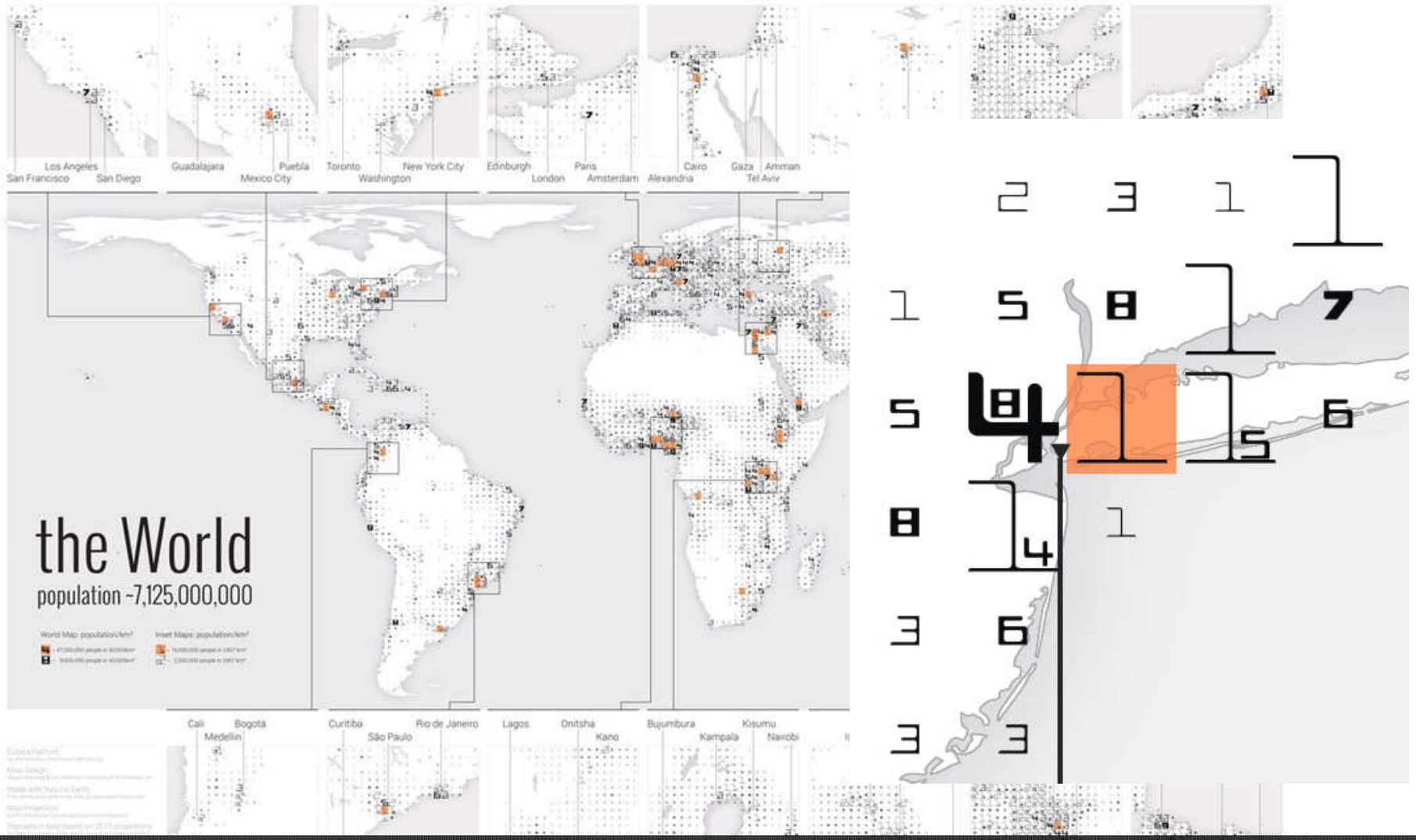


Scalar Field (KDE)

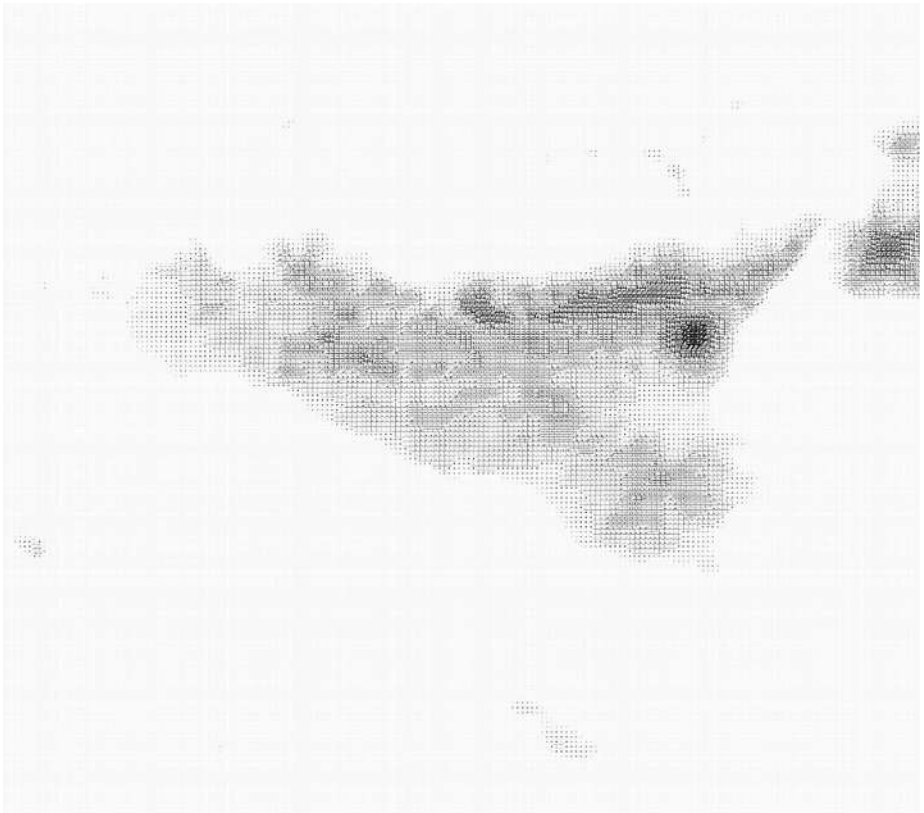
Scalar Field (heightmap)

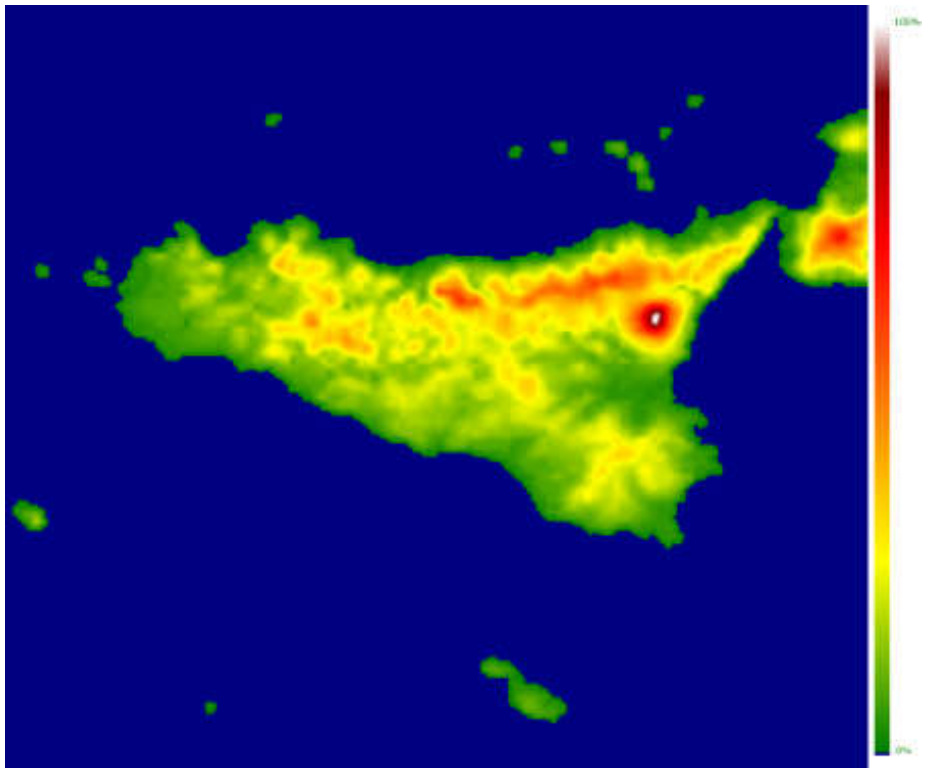


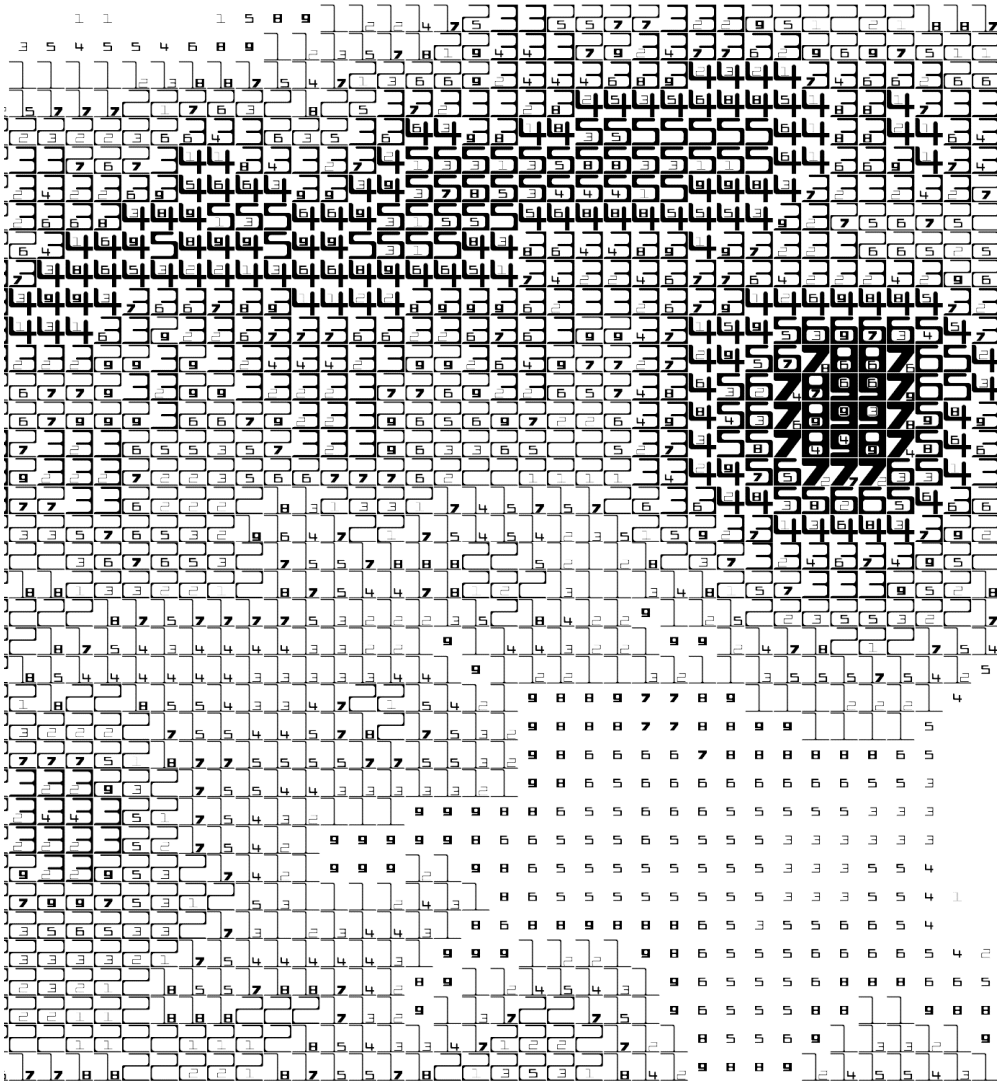
Sha Hwang. http://postarchitectural.com/Crime-Reports

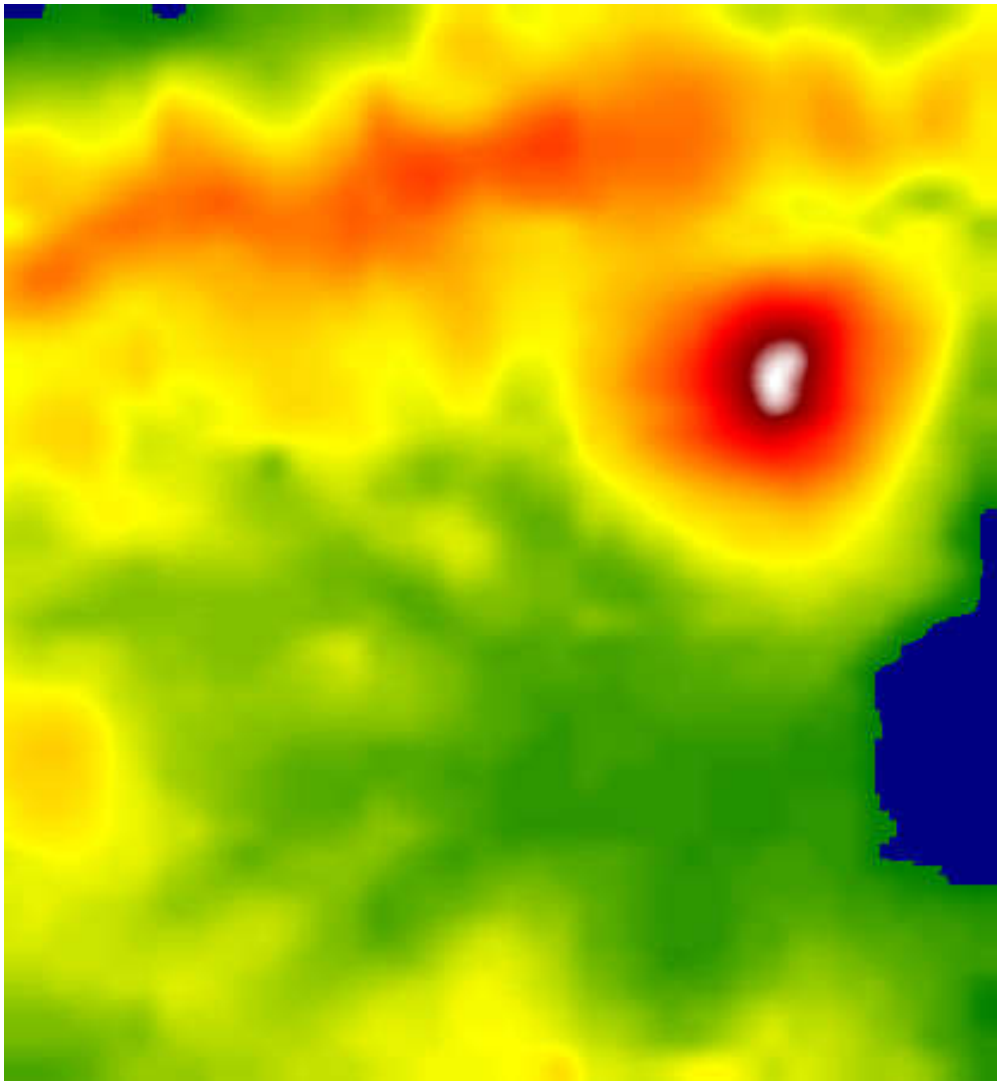


Nacenta, M., Hinrichs, U., & Carpendale, S. (2012, May). FatFonts: combining the symbolic and visual aspects of numbers. [ACM AVI]

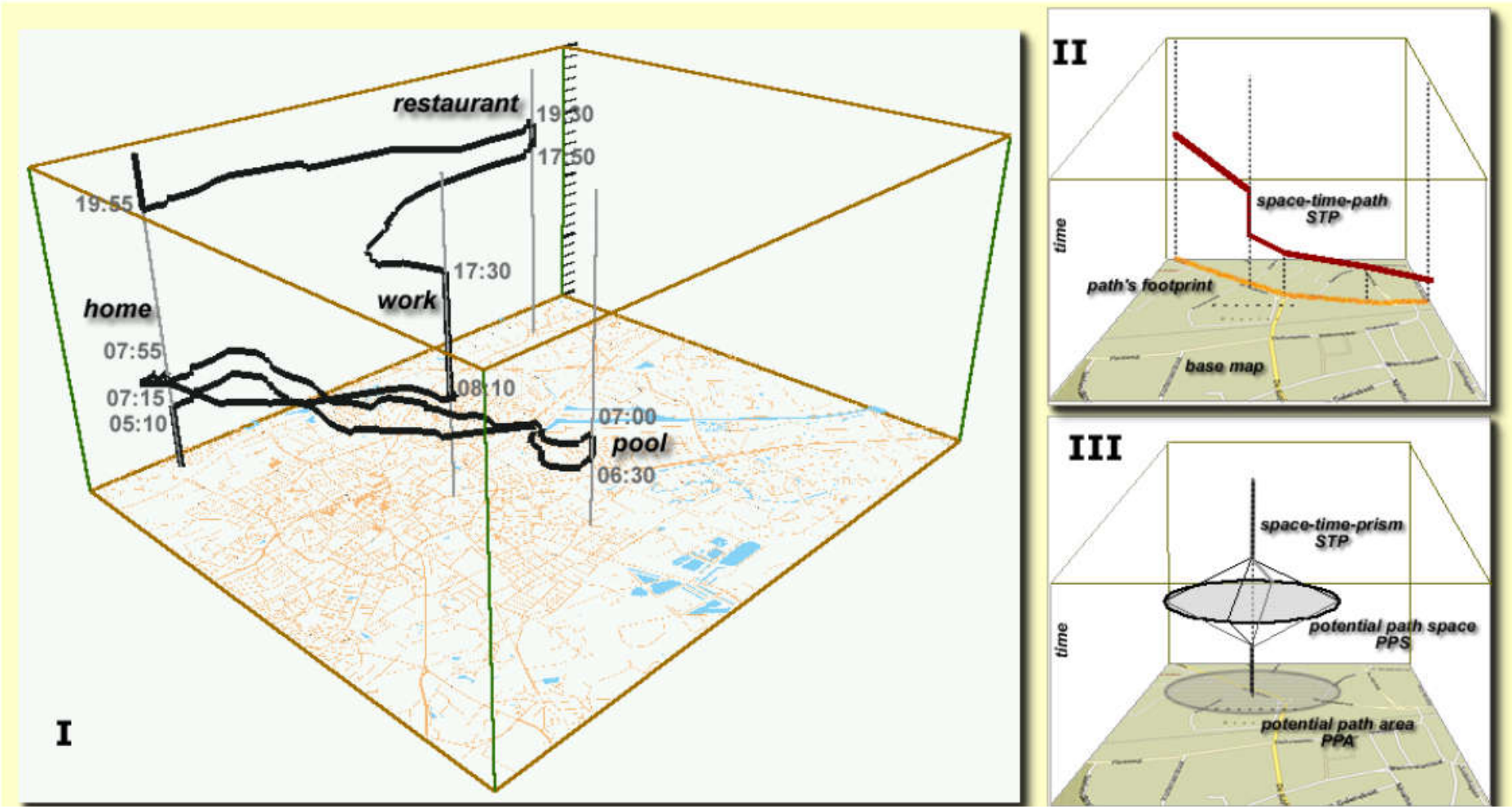




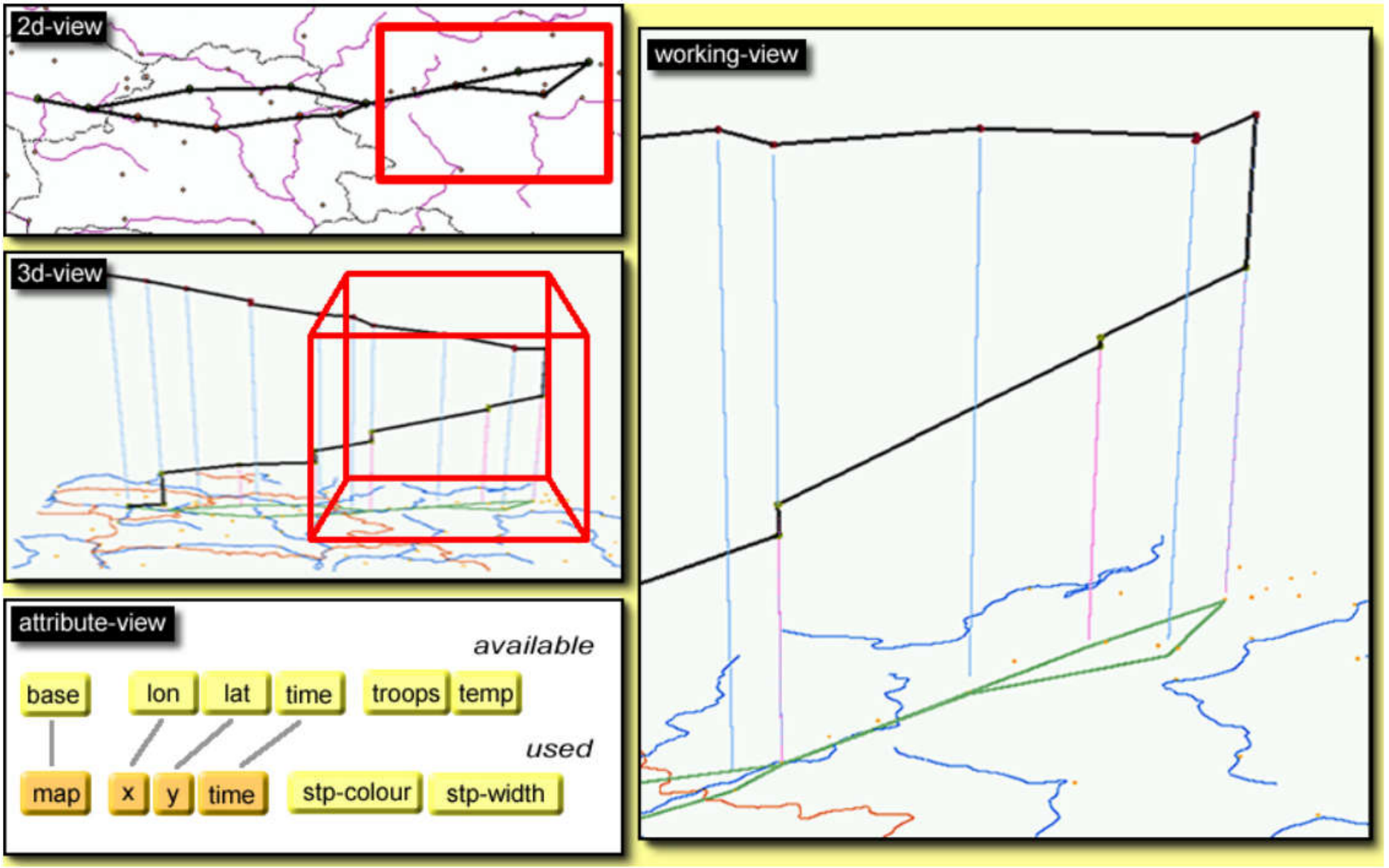




Space + Time



Kraak, M. J. (2003, August). **The space-time cube revisited from a geovisualization perspective**. In *Proc. 21st International Cartographic Conference*(pp. 1988-1996).


2d-view
3d-view
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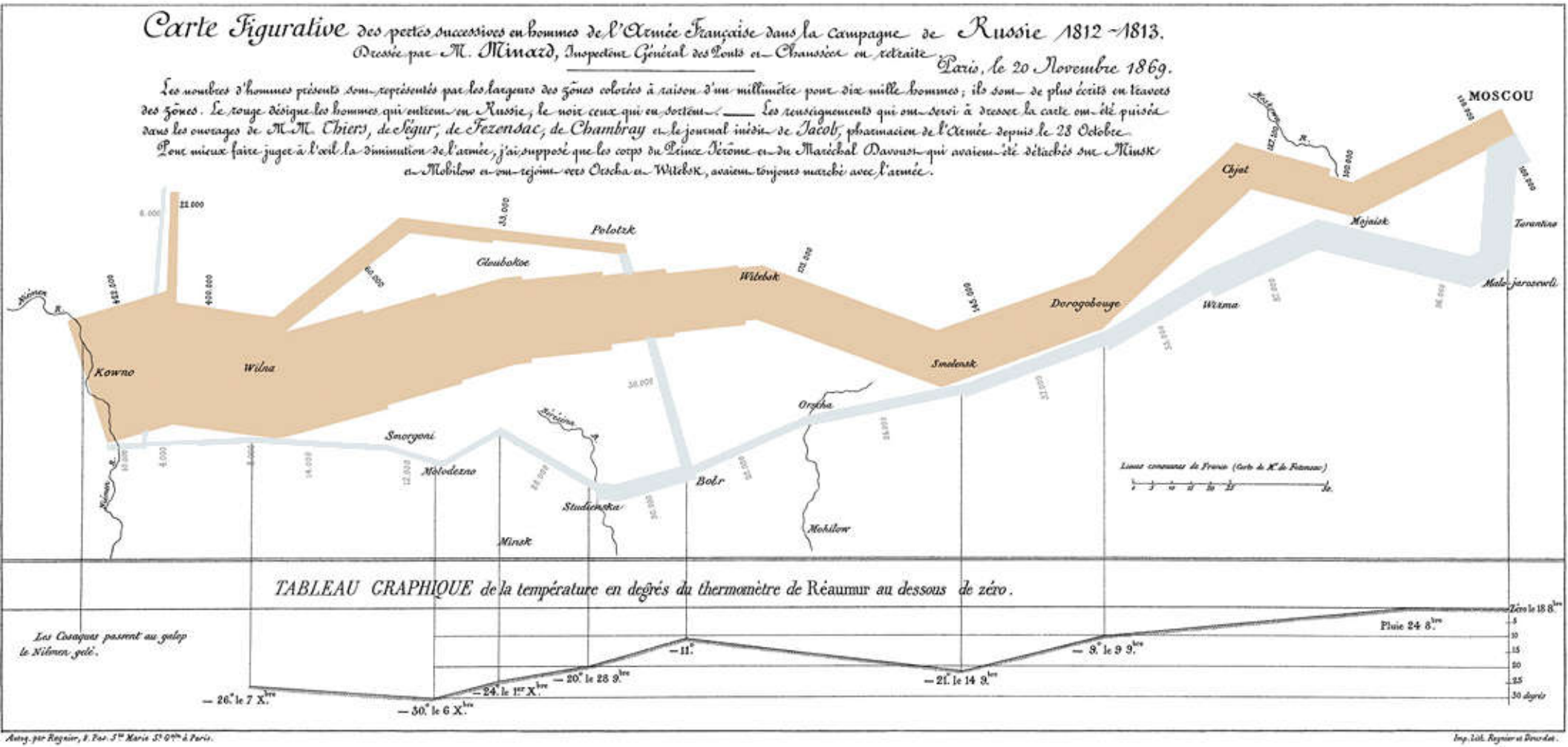
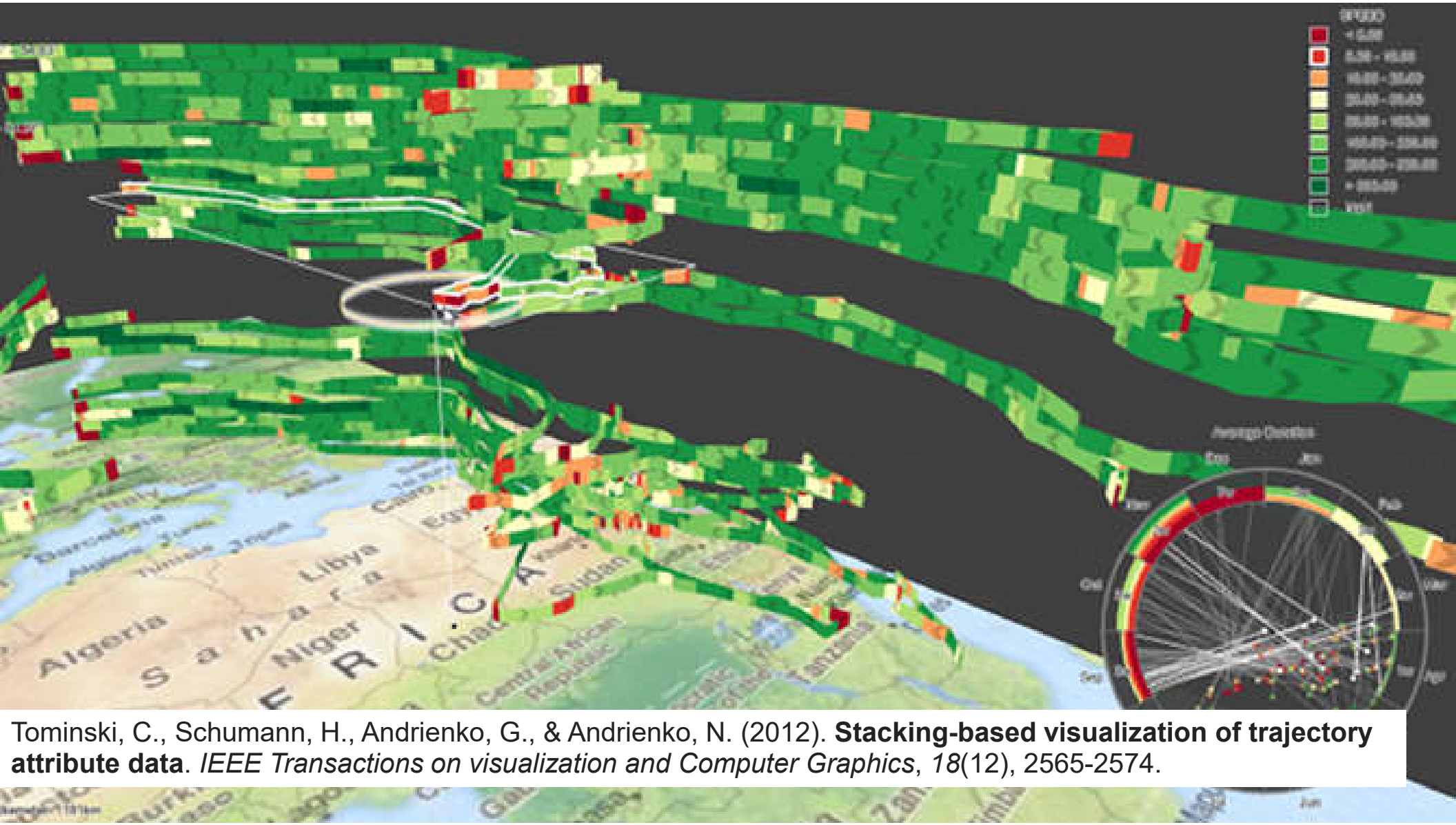
working-view



Minard, Charles. Reproduced by Tufte, E. in The Visual Display of Quantitative Information (1983), Graphics Press



Tominski, C., Schumann, H., Andrienko, G., & Andrienko, N. (2012). **Stacking-based visualization of trajectory attribute data**. *IEEE Transactions on visualization and Computer Graphics*, *18*(12), 2565-2574.

Let's Play a Game

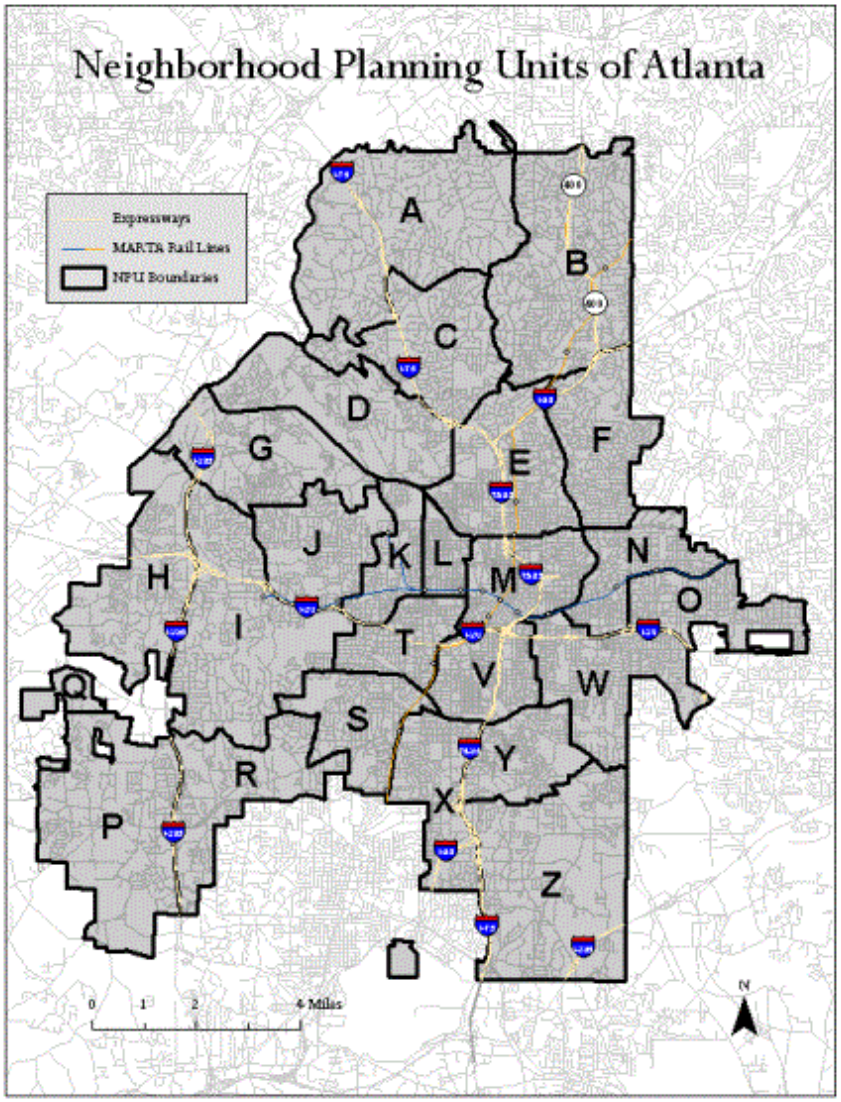
Pair Up

Who most recently posted to social media?

In it's a tie, figure out who is tallest.
If equal height, figure out who was born first.

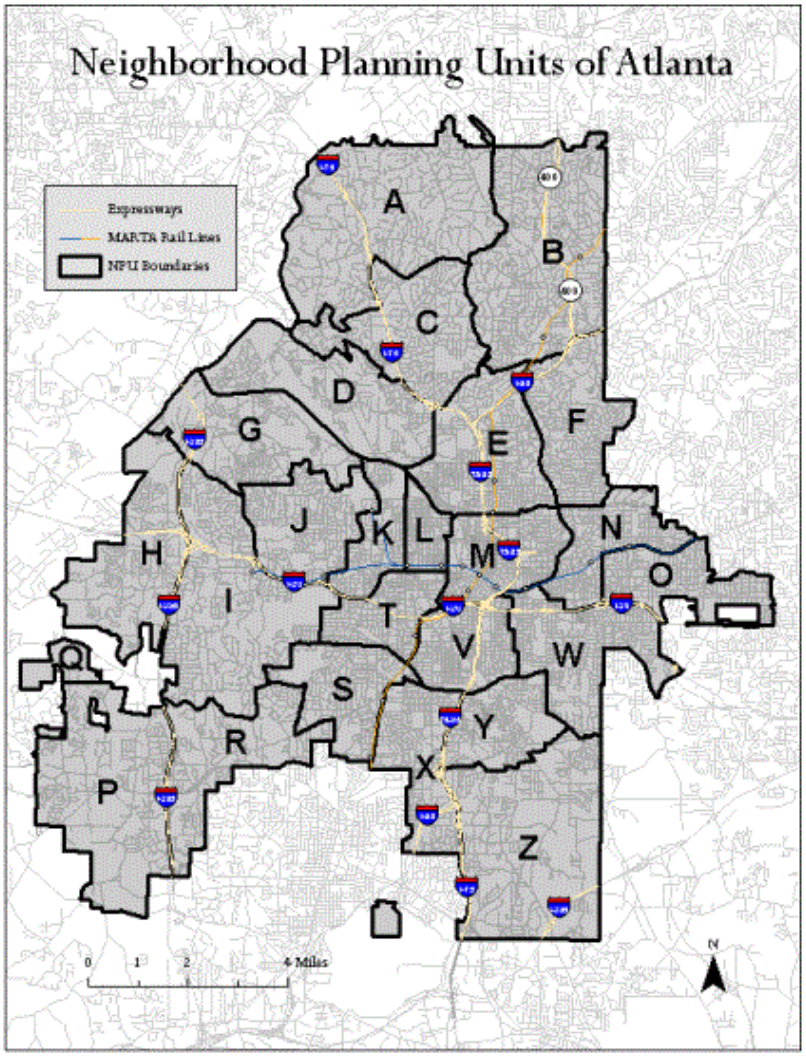
1	3 6 7
2	3 6 8
3	1 2
4	5 7
5	4 8
6	1 2
7	1 4 8
8	2 5 7

NPU	Cats (per capita)
J	5
K	7
L	2
M	12
T	20



1	3	6	7
2	3	6	8
3	1	2	
4	5	7	
5	4	8	
6	1	2	
7	1	4	8
8	2	5	7

NPU	Cats (per capita)
J	5
K	7
L	2
M	12
T	20

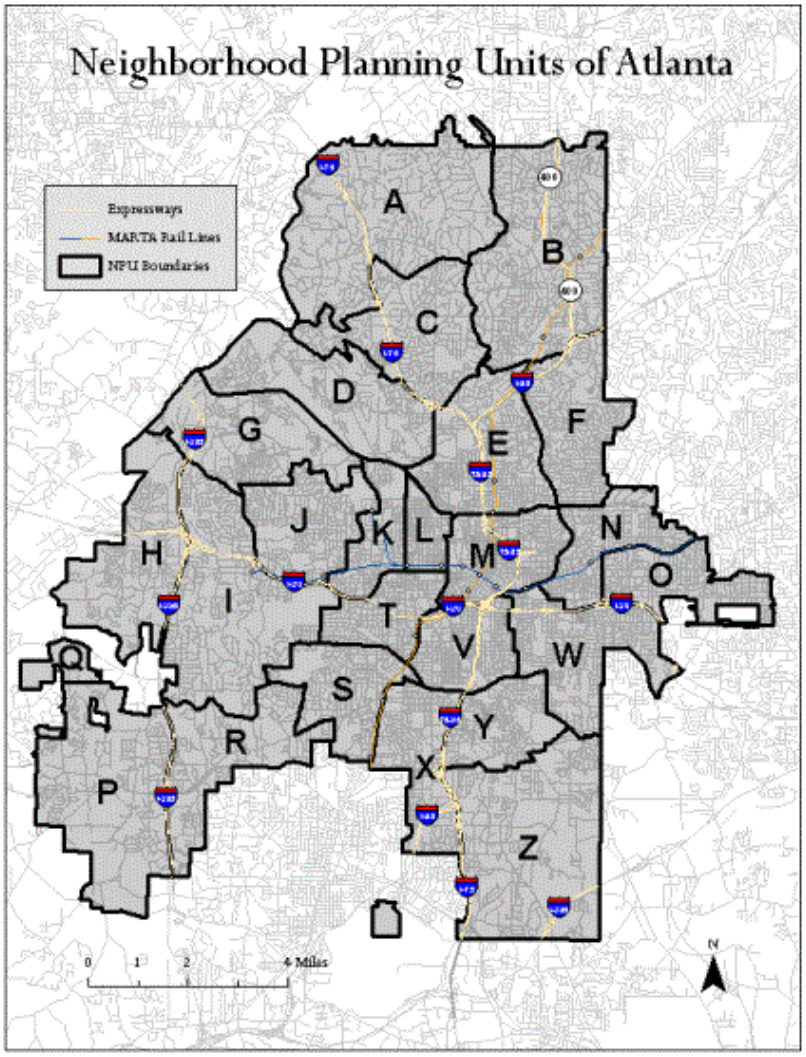


Merge Up

Time to work with your partner.

NPU	Node
J	1
K	2
L	3
M	4
T	5

NPU	Cats (per capita)	Node	Links
J	5	1	3
K	7	2	3
L	2	3	1 2
M	12	4	5
T	20	5	4



Let’s See What You Made

Prog Assign 1

- Complete last lab to help
- Due next Friday

Upcoming

- Overview & Detail
  - Prep: Powers of 10 video
- Interaction