

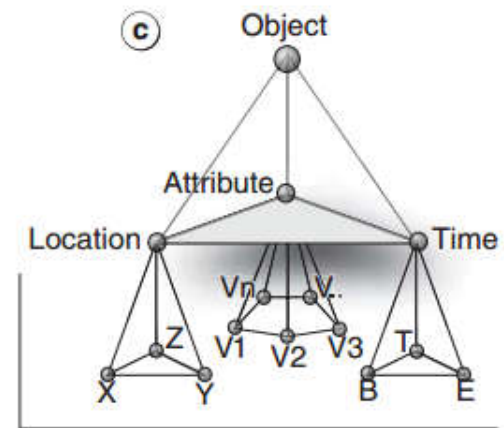
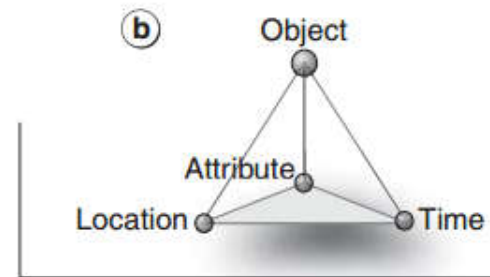
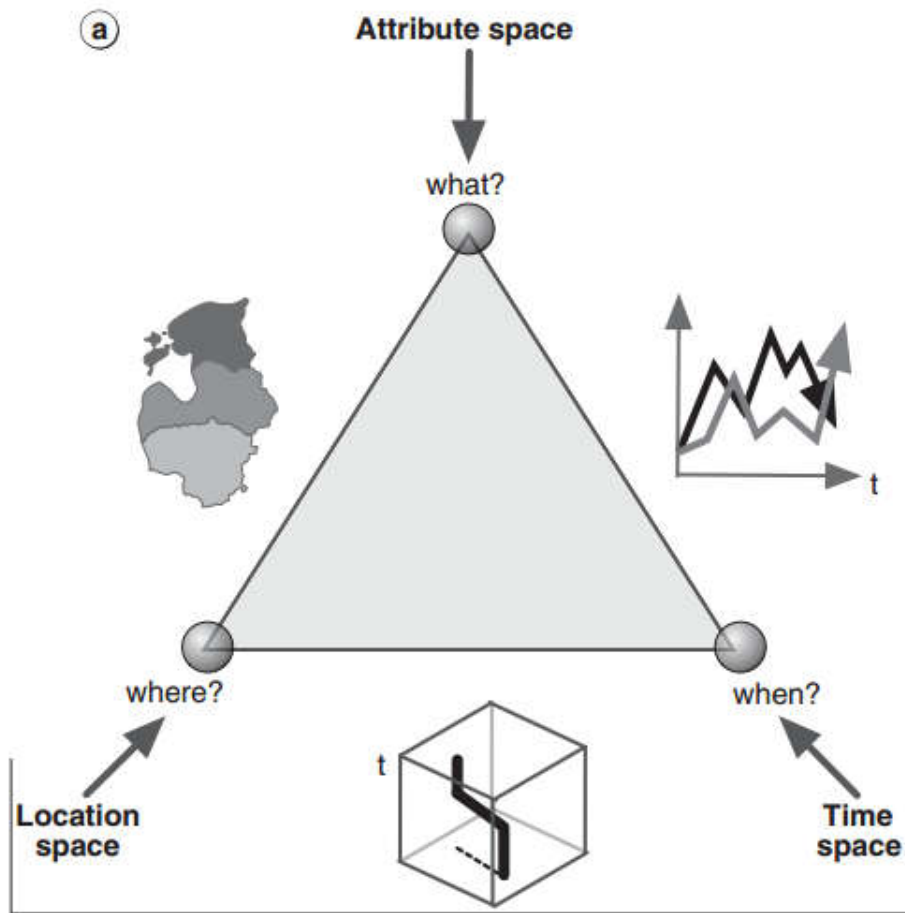
# Geovisualization

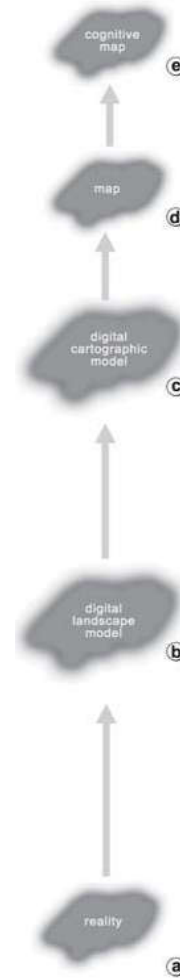
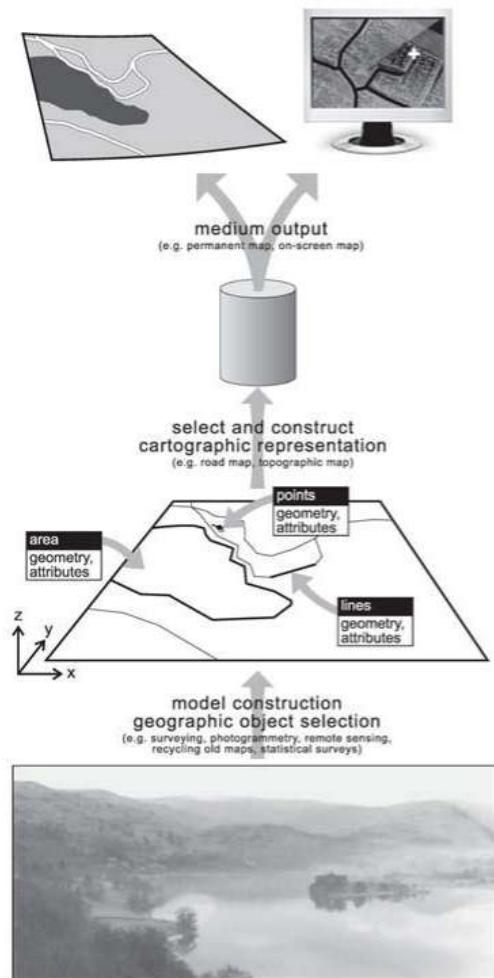
Alex Godwin

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]







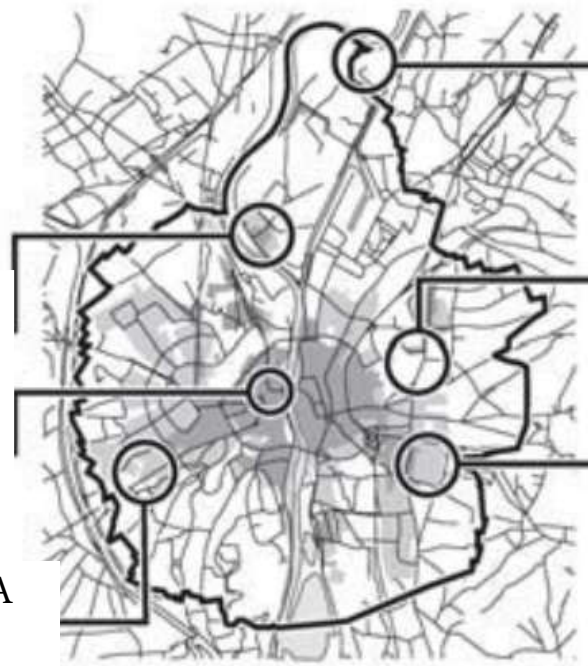
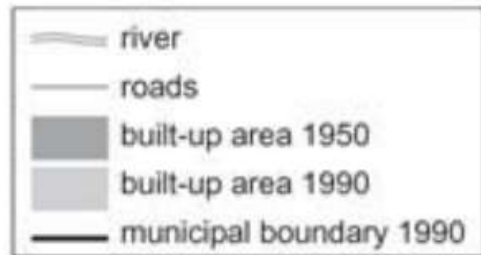
**Cognitive map:**  
interpretation of reality by  
map reader / analyst

**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



**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?

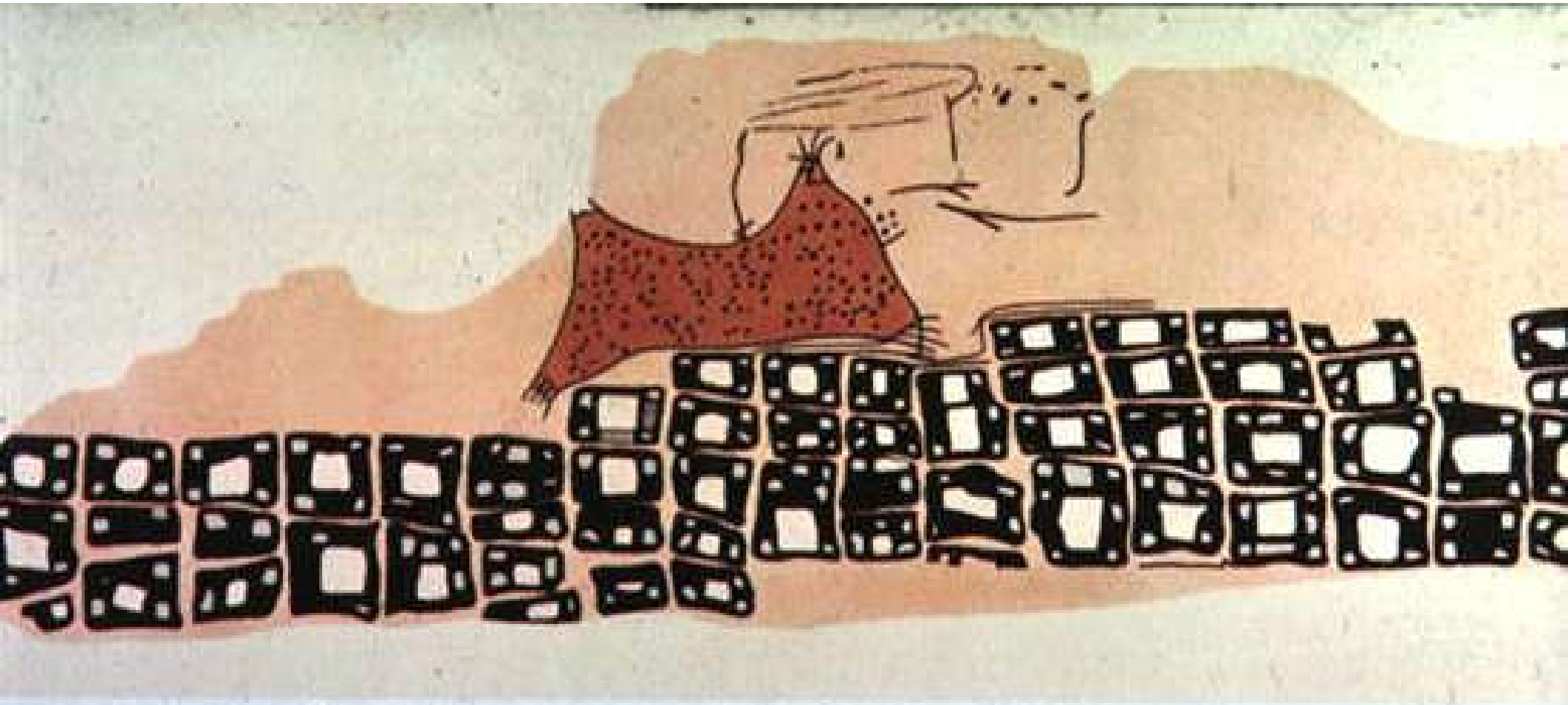
**Pattern:** river interrupts road network

**What if:** a new built-up area is created here?

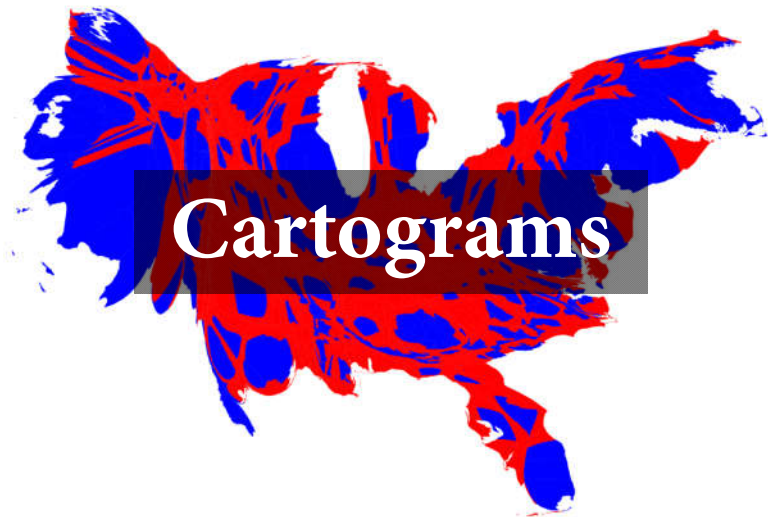
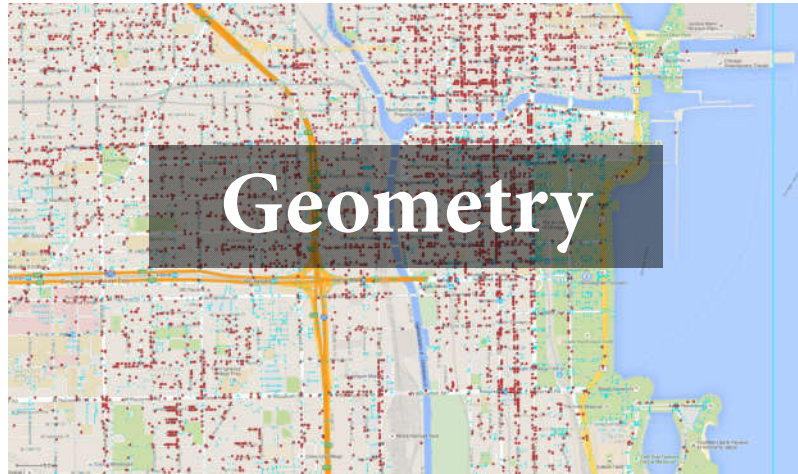
**models:** will affect traffic intensity

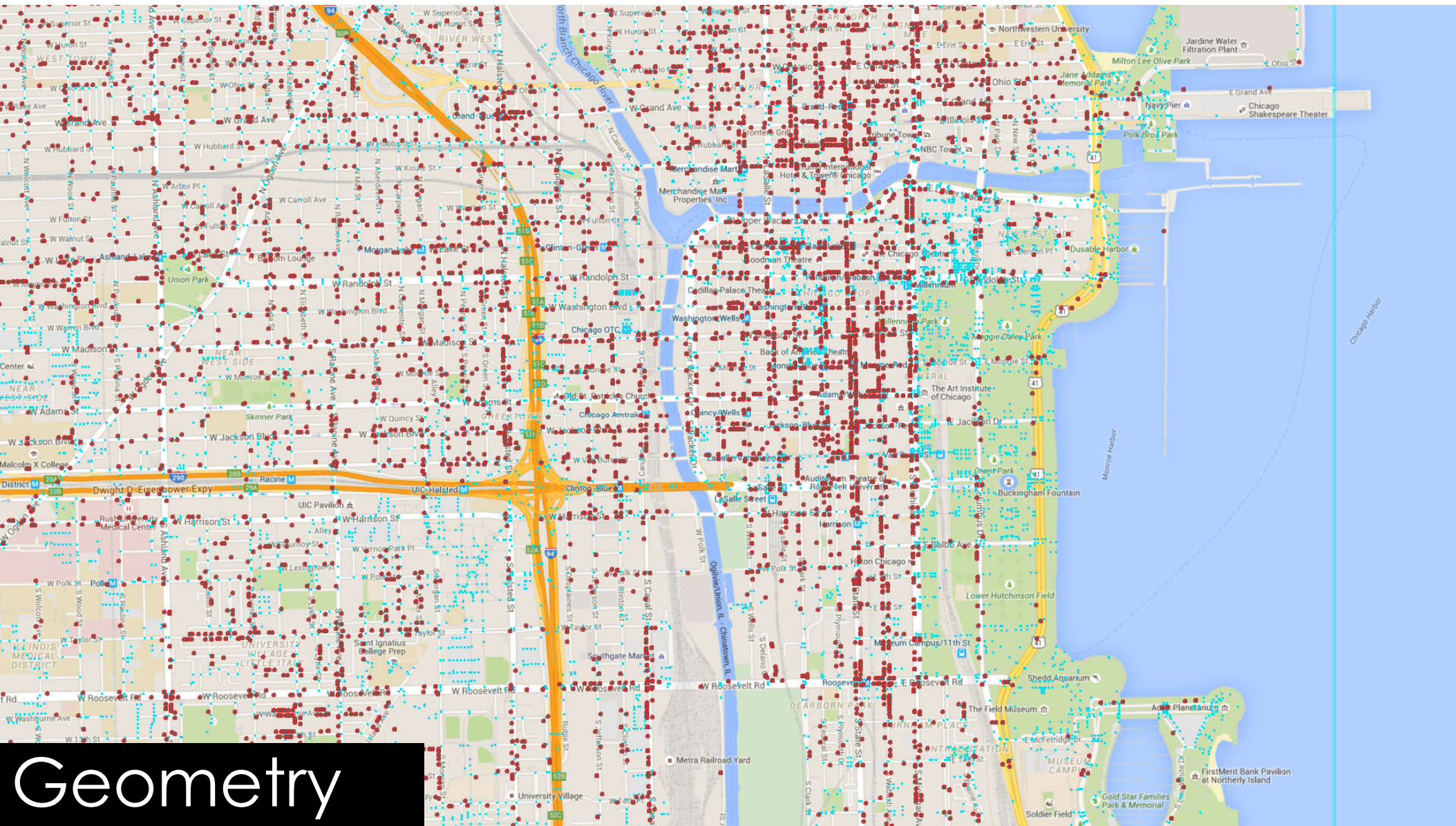
**What has changed?**

**trends:** growth urban area



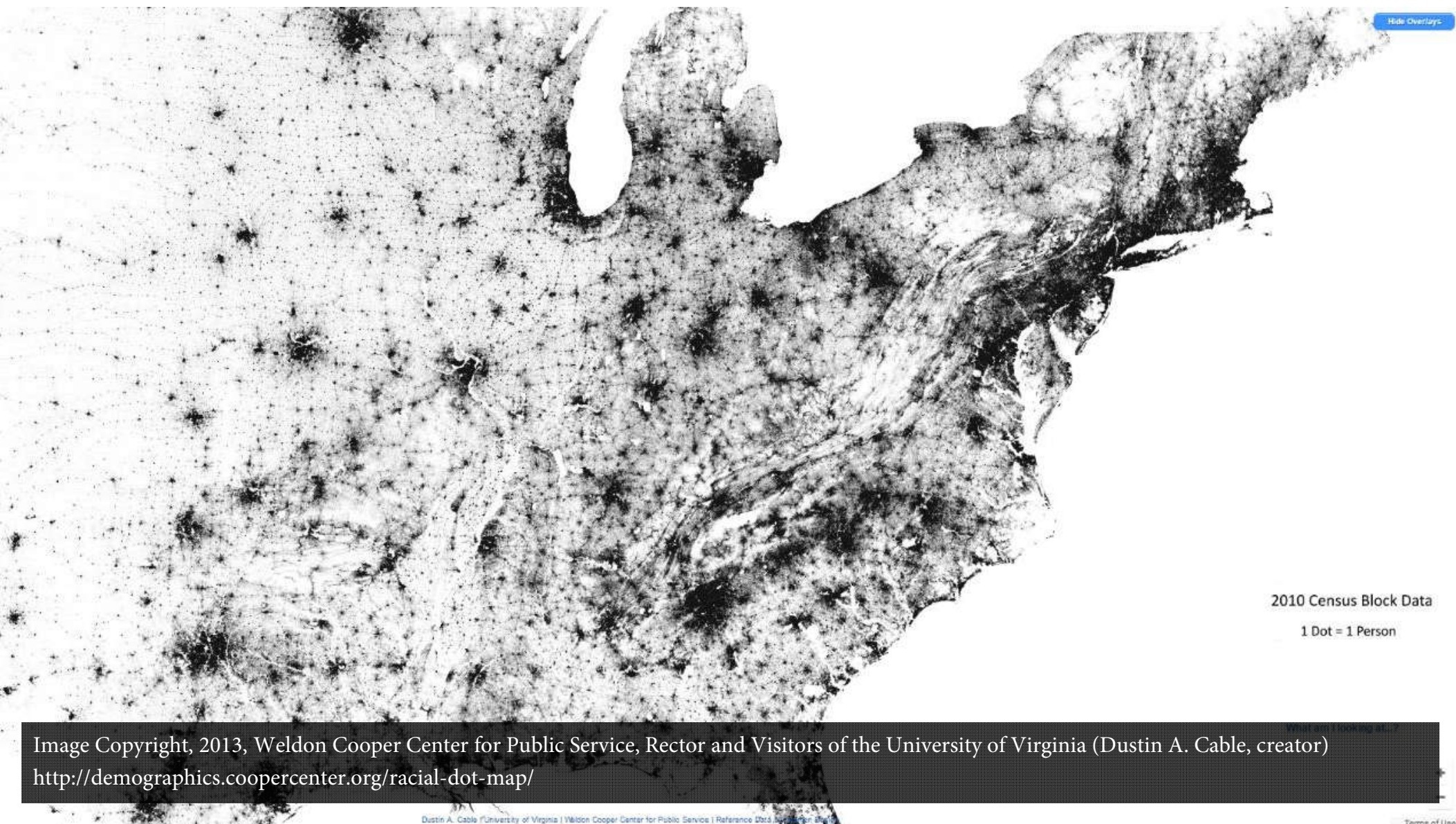
Schmitt AK et al. 2014. Identifying the Volcanic Eruption Depicted in a Neolithic Painting at Çatalhöyük, Central Anatolia, Turkey. PLoS ONE 9 (1): e84711; doi: 10.1371/journal.pone.0084711





# Geometry





Hide Overlays

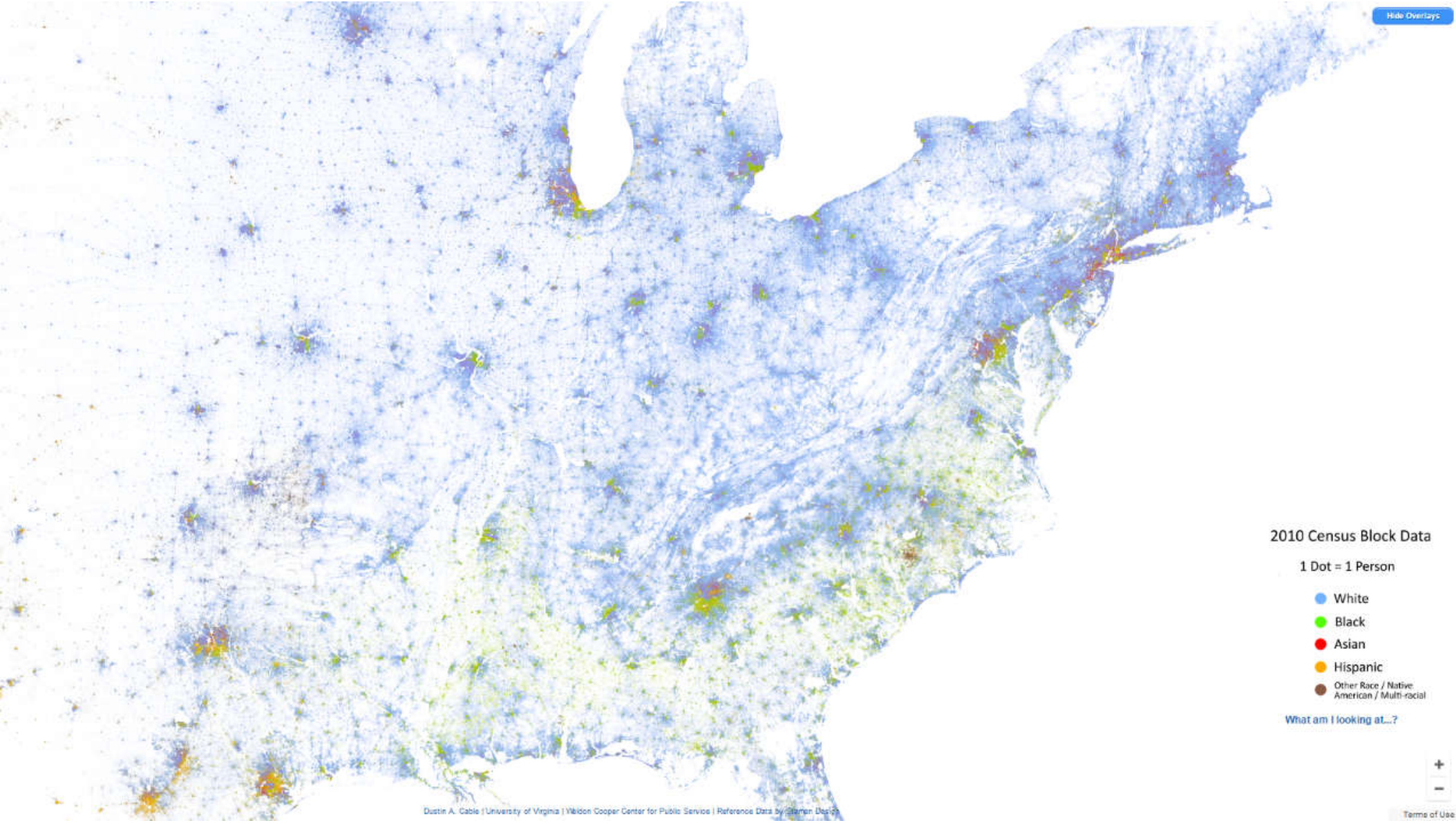
2010 Census Block Data

1 Dot = 1 Person

Image Copyright, 2013, Weldon Cooper Center for Public Service, Rector and Visitors of the University of Virginia (Dustin A. Cable, creator)  
<http://demographics.coopercenter.org/racial-dot-map/>

Dustin A. Cable | University of Virginia | Weldon Cooper Center for Public Service | Reference Maps | [View Larger Map](#)

Terms of Use



Hide Overlays

### 2010 Census Block Data

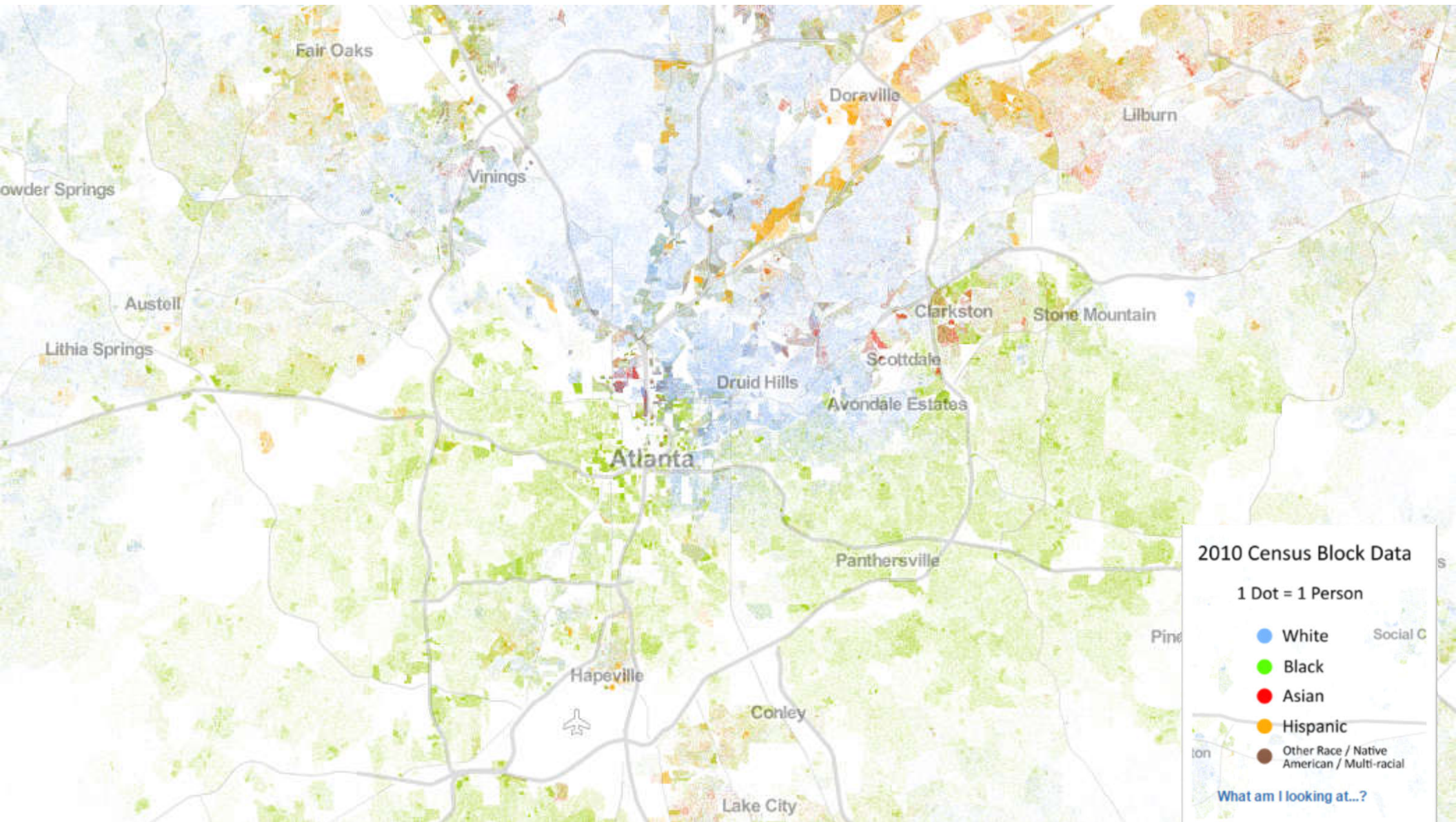
1 Dot = 1 Person

- White
- Black
- Asian
- Hispanic
- Other Race / Native American / Multi-racial

What am I looking at...?

+  
-

Terms of Use





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

Carte Figurative et approximative des tonnages des GRANDS PORTS et des principales RIVIÈRES D'EUROPE  
 dressée par M. MINARD Inspecteur général des Ponts et Chaussées en retraite.  
 Paris, 27 Octobre 1859.

LÉGENDE EXPLICATIVE.

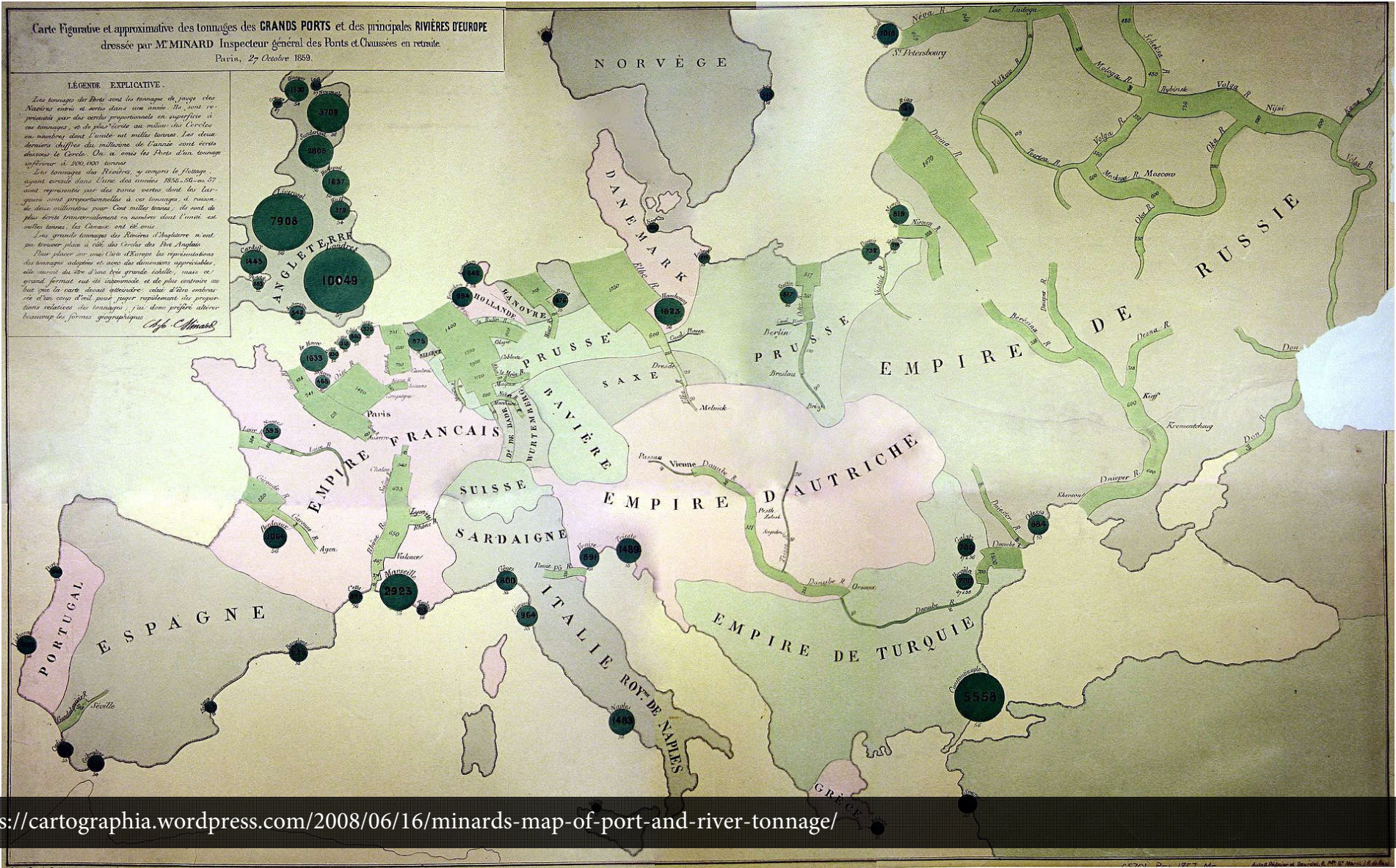
Les tonnages des Ports sont les tonnages de jauge des Nations entrés et sortis dans un an. Ils sont représentés par des cercles proportionnels en superficie à ces tonnages, et de plus écrits au milieu des Cercles en nombres dont l'unité est mille tonnes. Les deux derniers chiffres des millions de tonnes sont écrits dessous le Cercle. On se rendra les Ports d'un tonnage supérieur à 500,000 tonnes.

Les tonnages des Rivières, y compris le fleuve, ayant été dans l'Etat des années 1854-55, sont représentés par des cercles dont les diamètres sont proportionnels à ces tonnages, à raison de deux millimètres pour Cent mille tonnes, ils sont de plus écrits littéralement en nombres dont l'unité est mille tonnes, les zéros ont été mis.

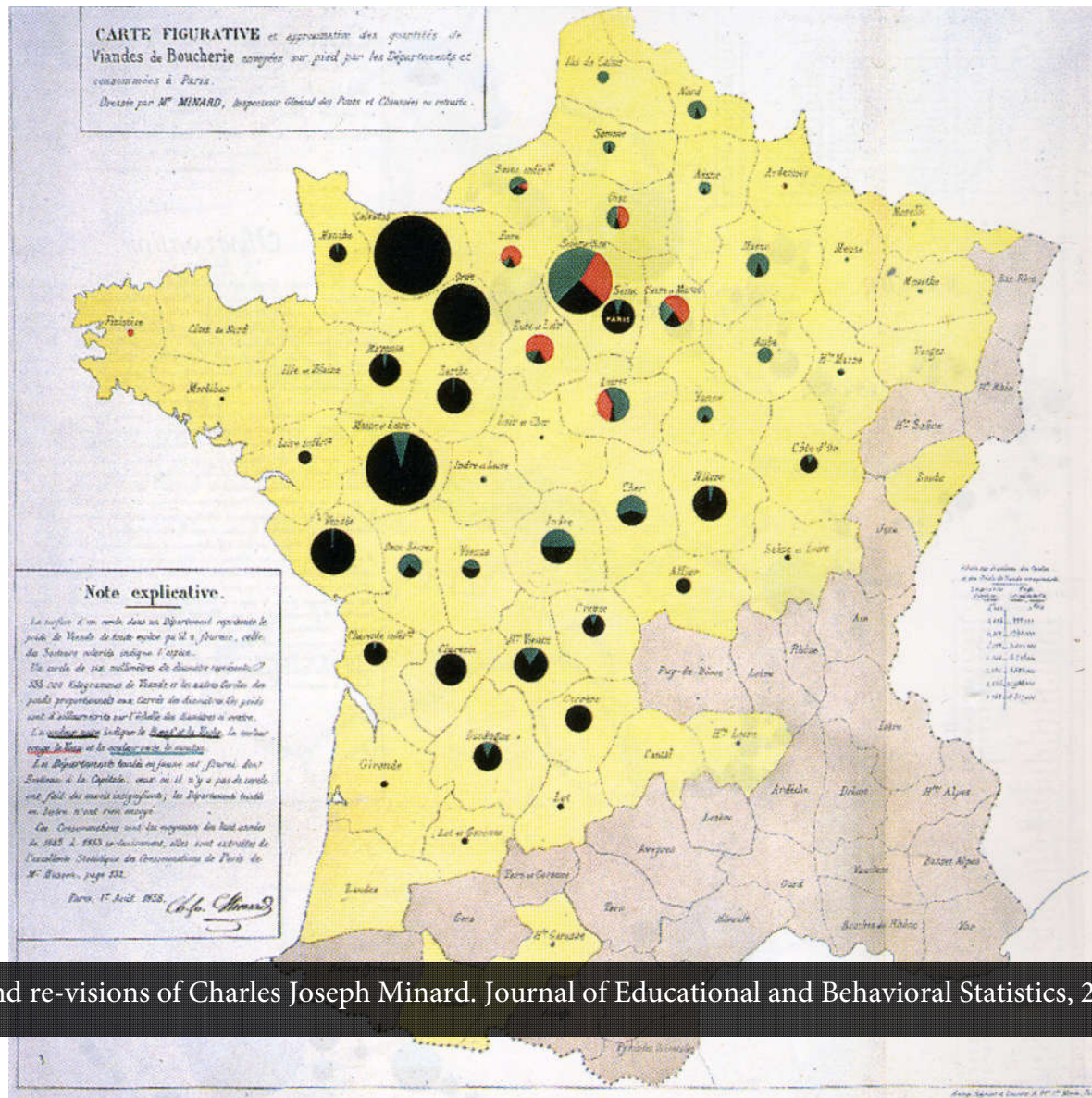
Les grands tonnages des Rivières d'Angleterre n'ont pu trouver place à côté des Cercles des Ports Anglais.

Pour plus de simplicité l'Europe les représentations des tonnages adoptés et avec des dimensions appropriées ont été mis de côté d'un très grand cercle, dans ce grand format est de commodité et de plus continue au bas de la carte, devant servir, sous d'un autre point de vue, à l'œil pour juger rapidement les proportions relatives des tonnages, par deux cercles placés l'un à côté de l'autre.

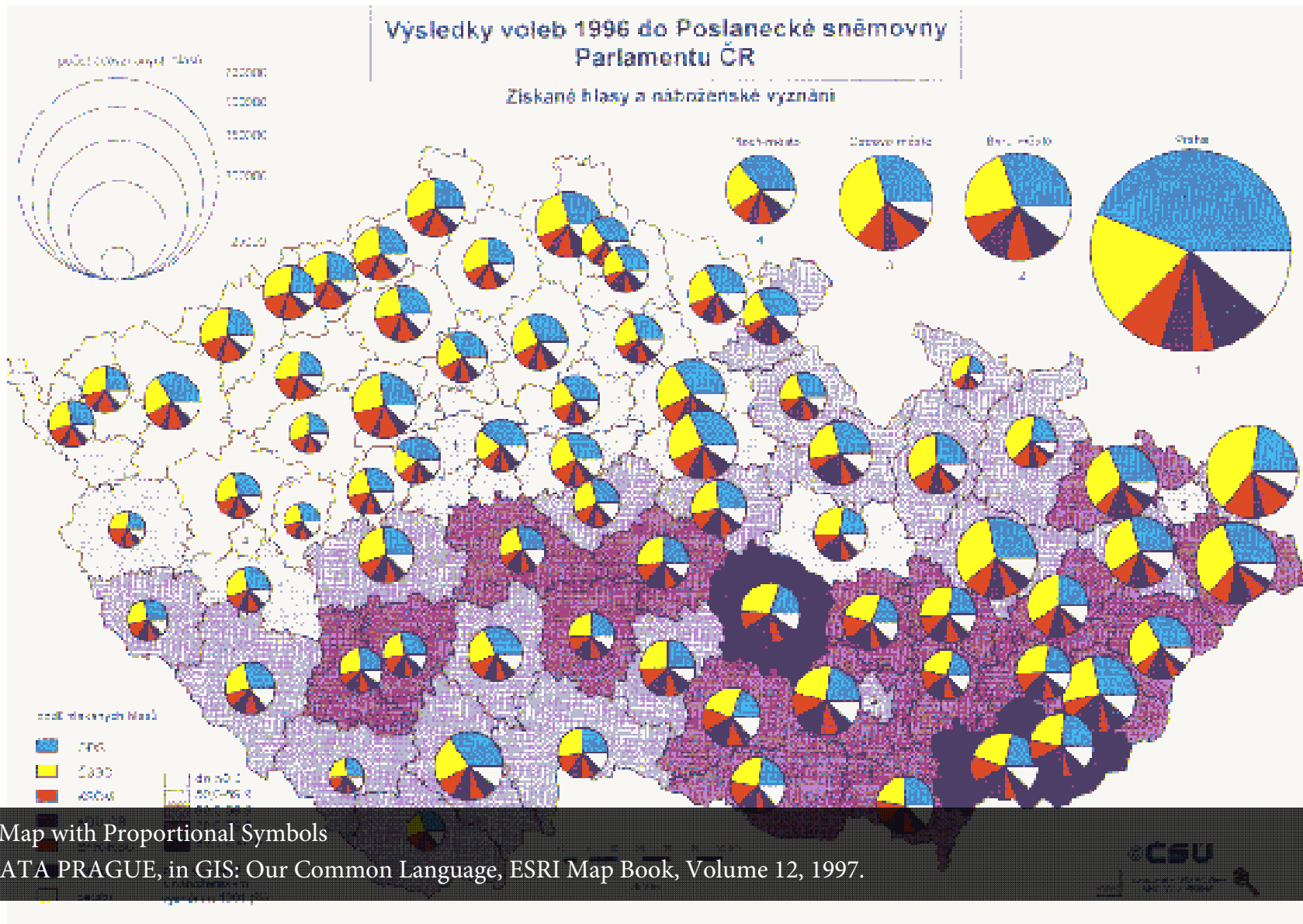
*Ch. Minard*



<https://cartographia.wordpress.com/2008/06/16/minards-map-of-port-and-river-tonnage/>

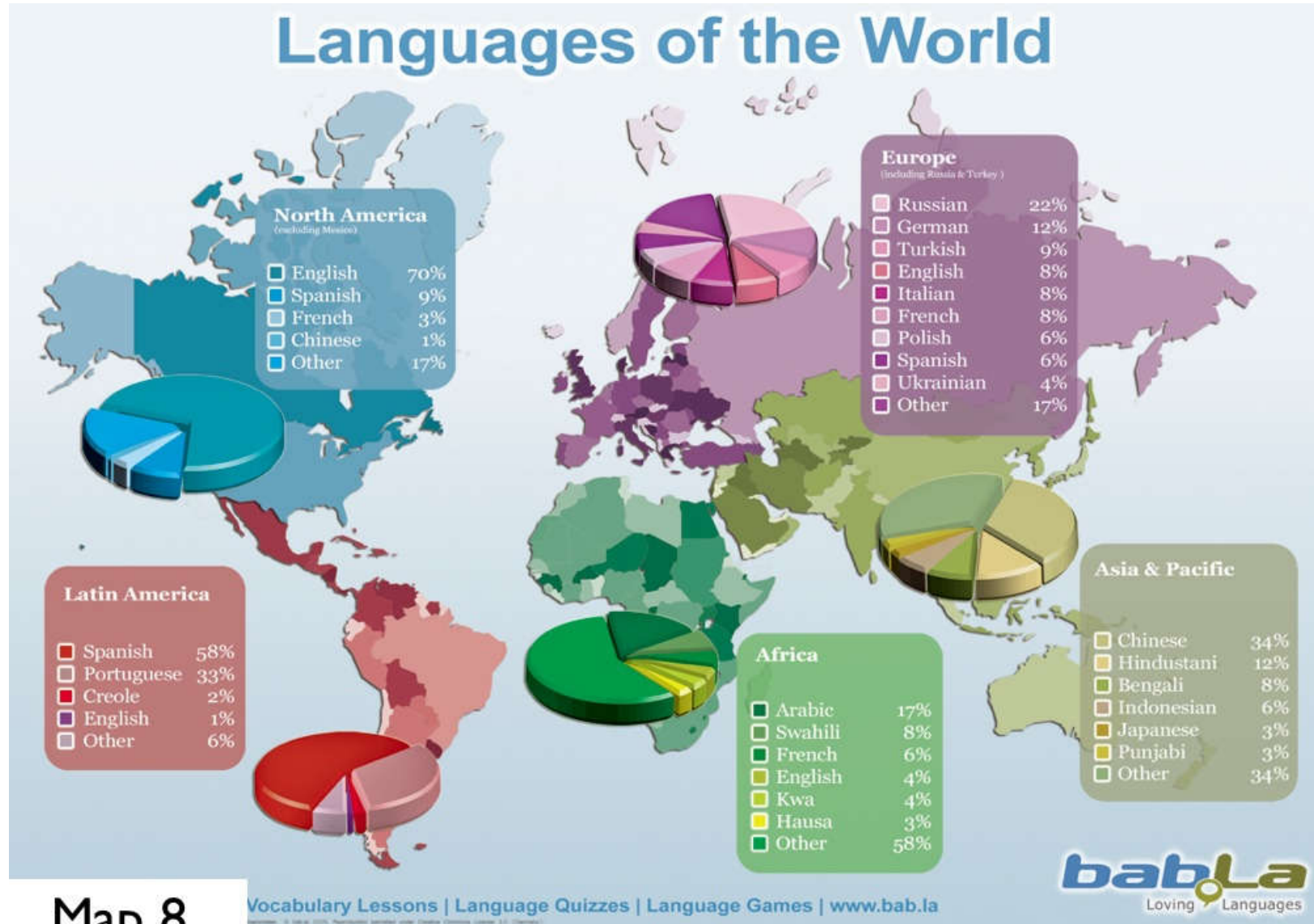


Friendly, M. (2002). Visions and re-visions of Charles Joseph Minard. *Journal of Educational and Behavioral Statistics*, 27(1), 31-51



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

# Languages of the World



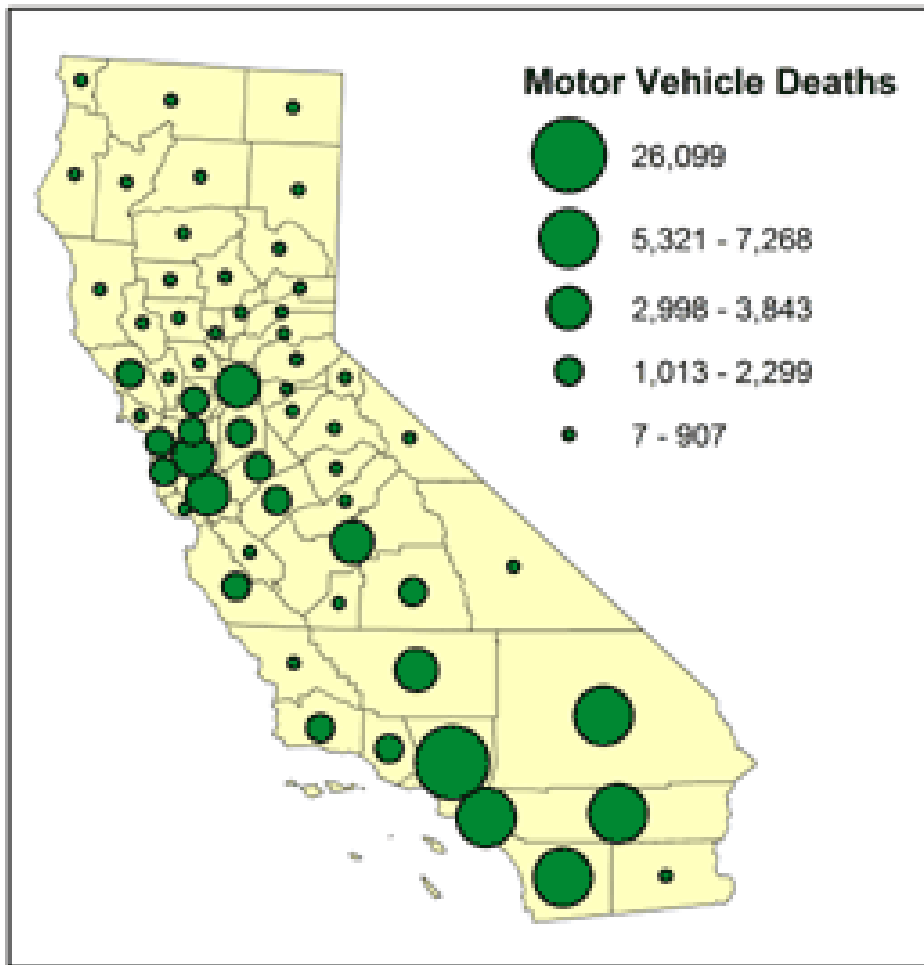
Map 8

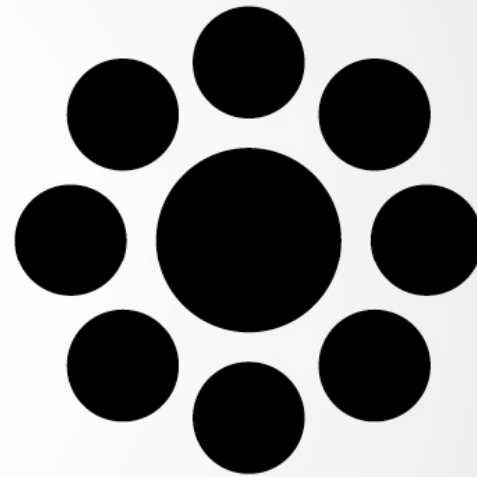
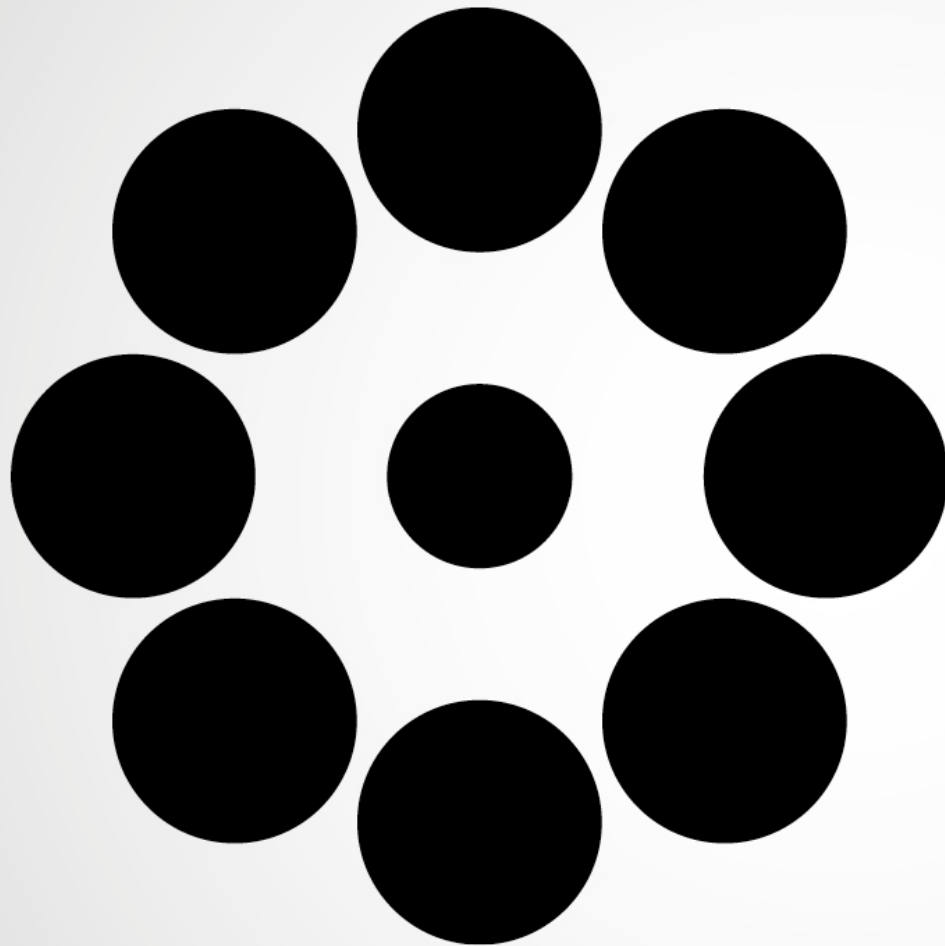
Vocabulary Lessons | Language Quizzes | Language Games | [www.bab.la](http://www.bab.la)

**babLa**  
Loving Languages

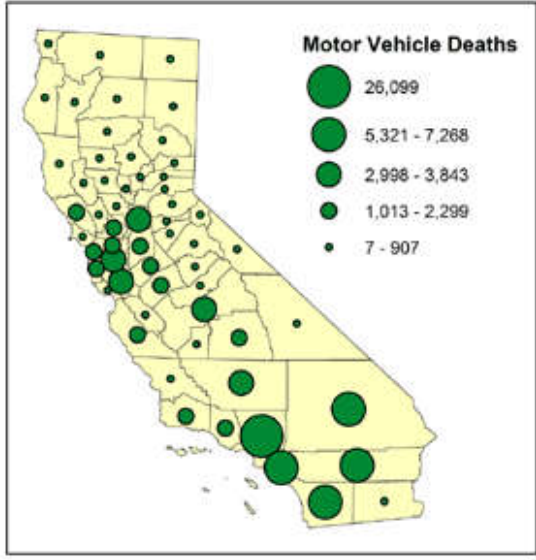
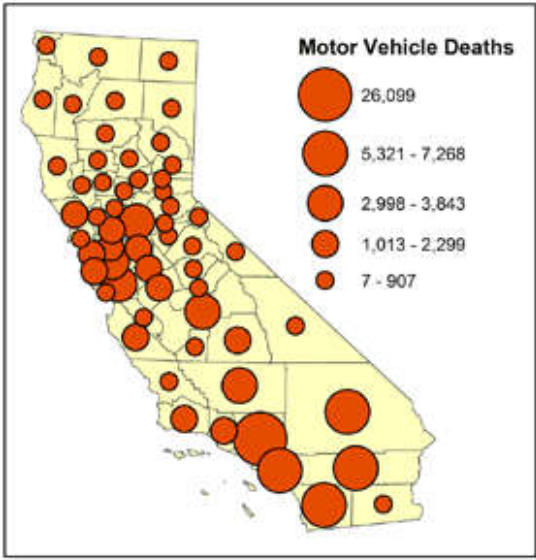
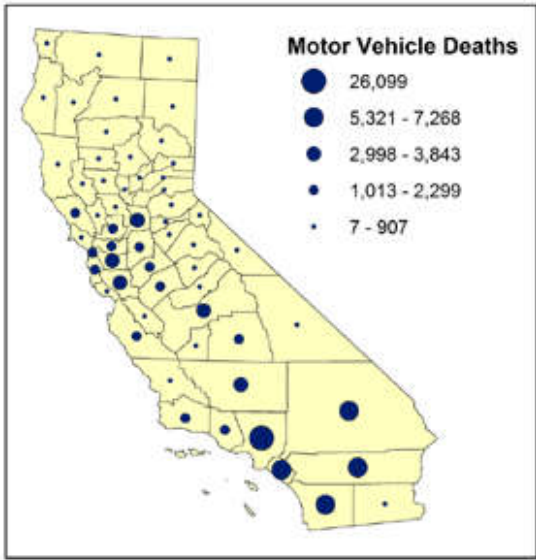
<http://en.bab.la/news/world-languages.html>

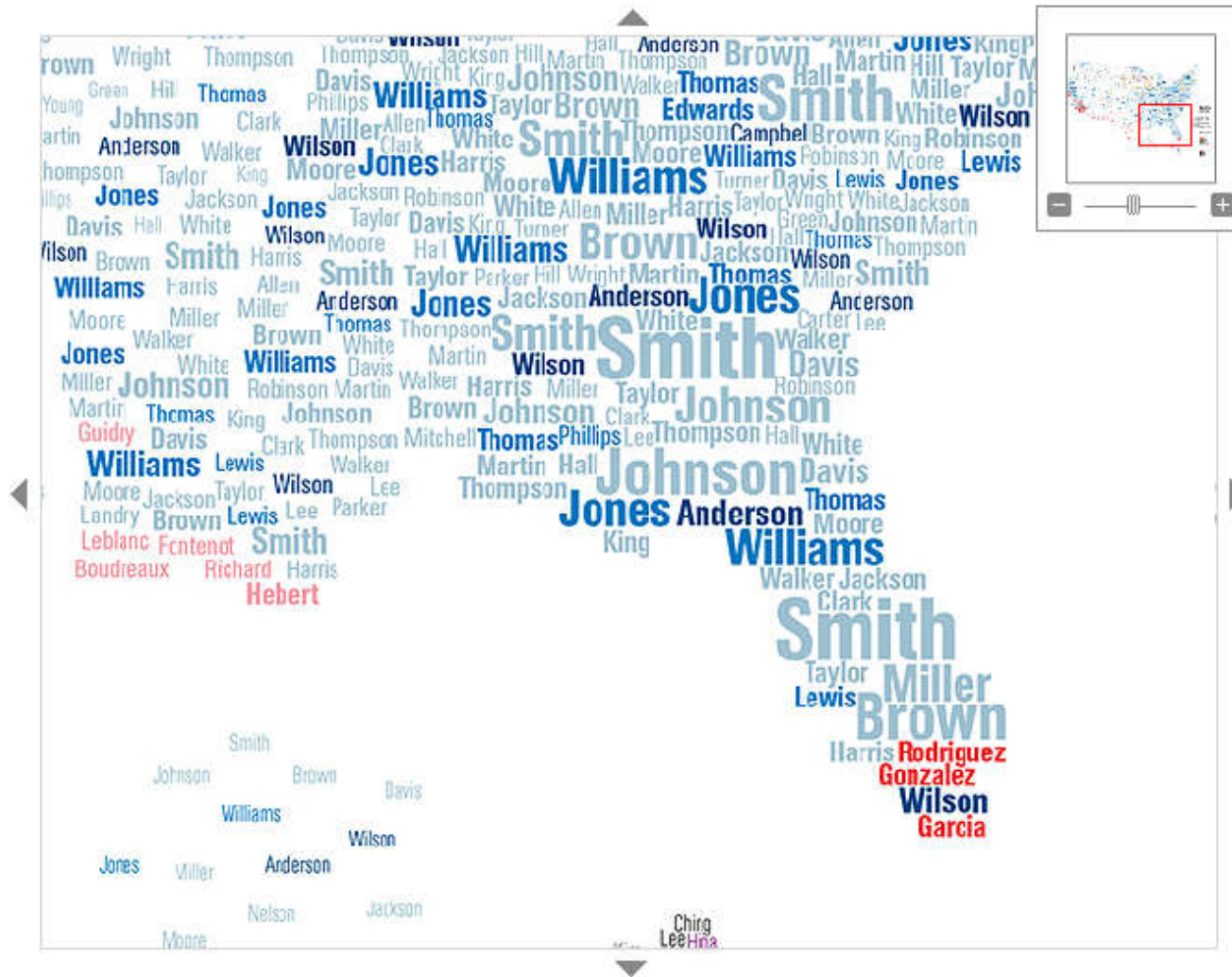




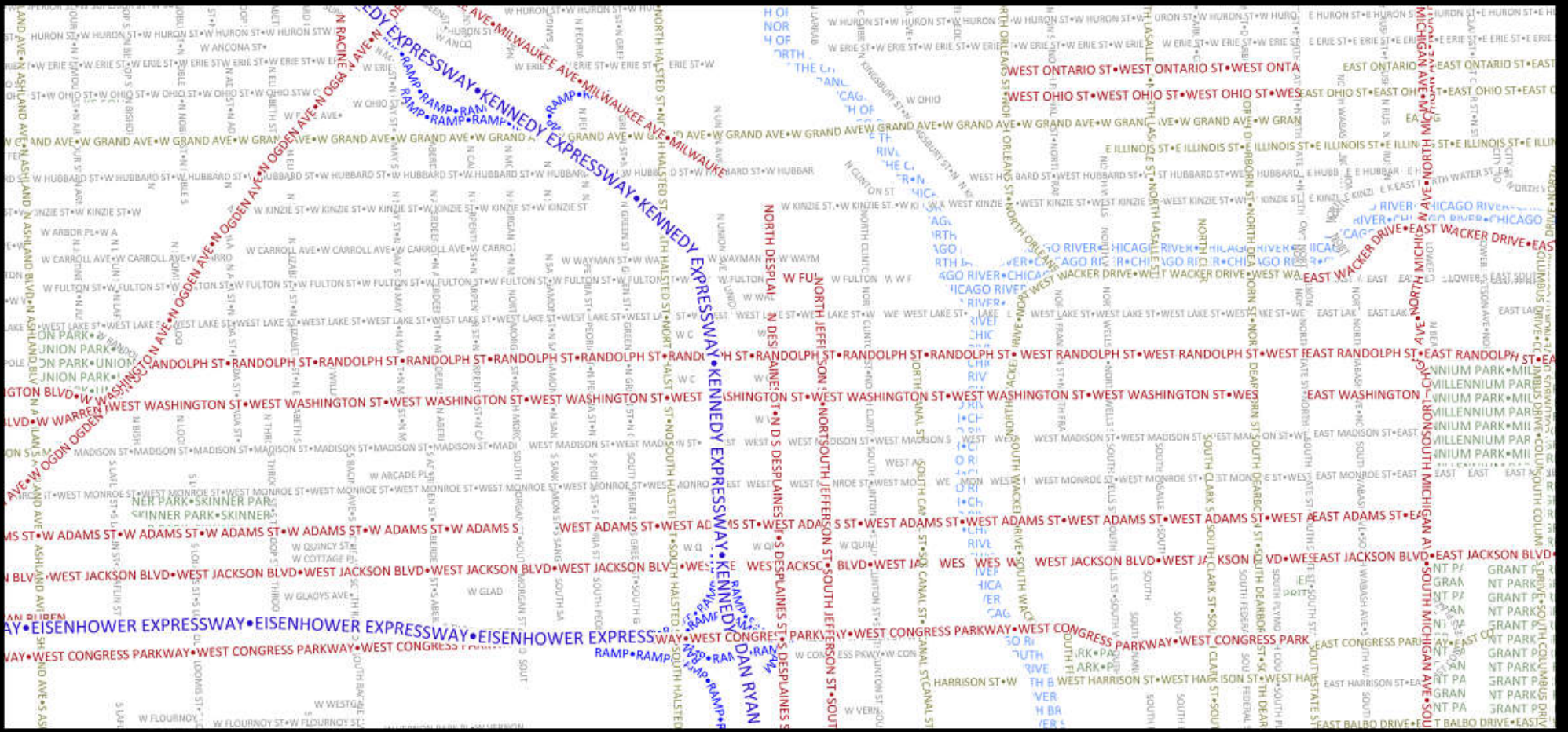


Ebbinghaus, H. The Ebbinghaus Illusion. [https://en.wikipedia.org/wiki/Ebbinghaus\\_illusion](https://en.wikipedia.org/wiki/Ebbinghaus_illusion)





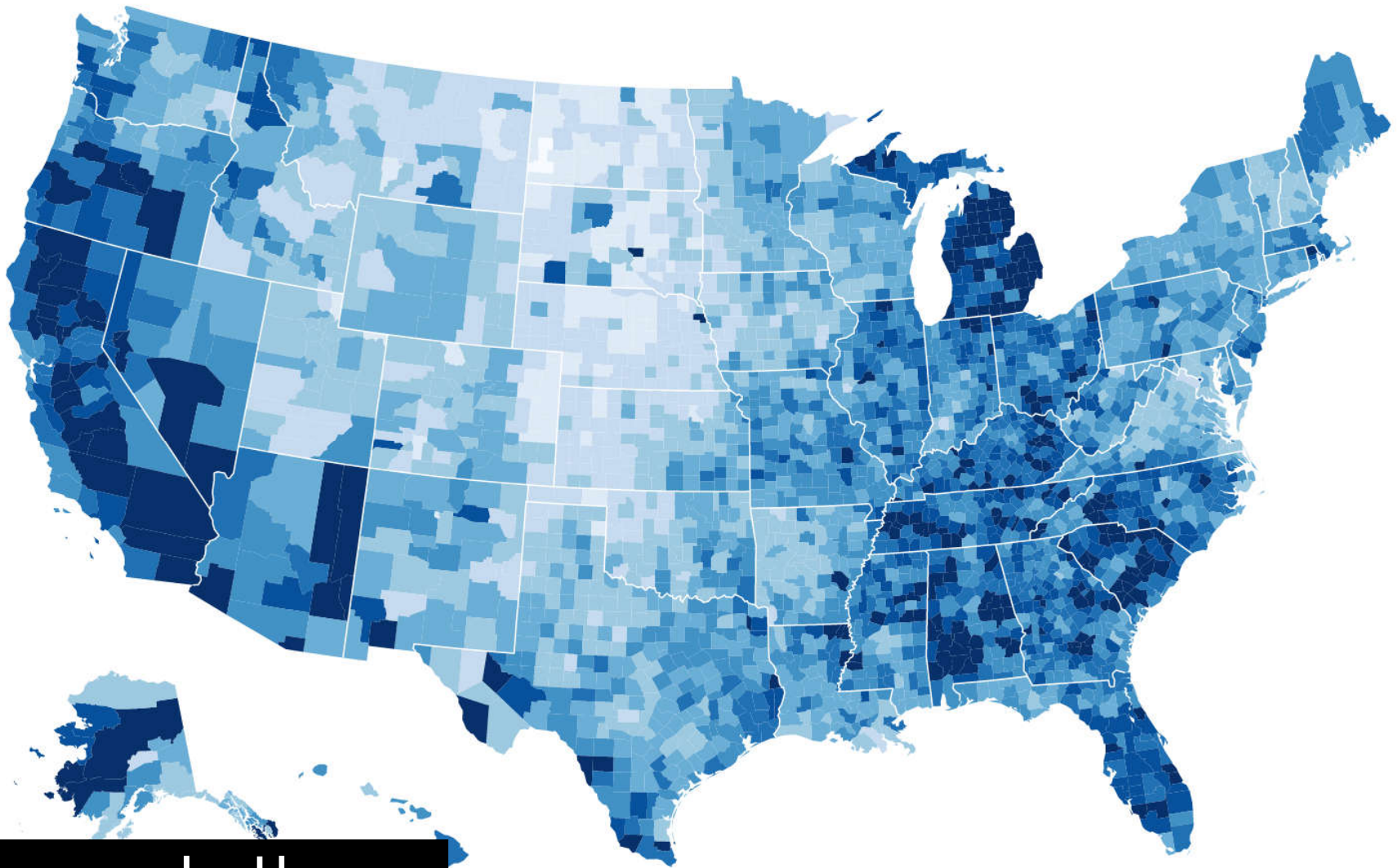
2011. "What's in a Surname?", National Geographic. <http://ngm.nationalgeographic.com/2011/02/geography/usa-surnames-interactive>



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.

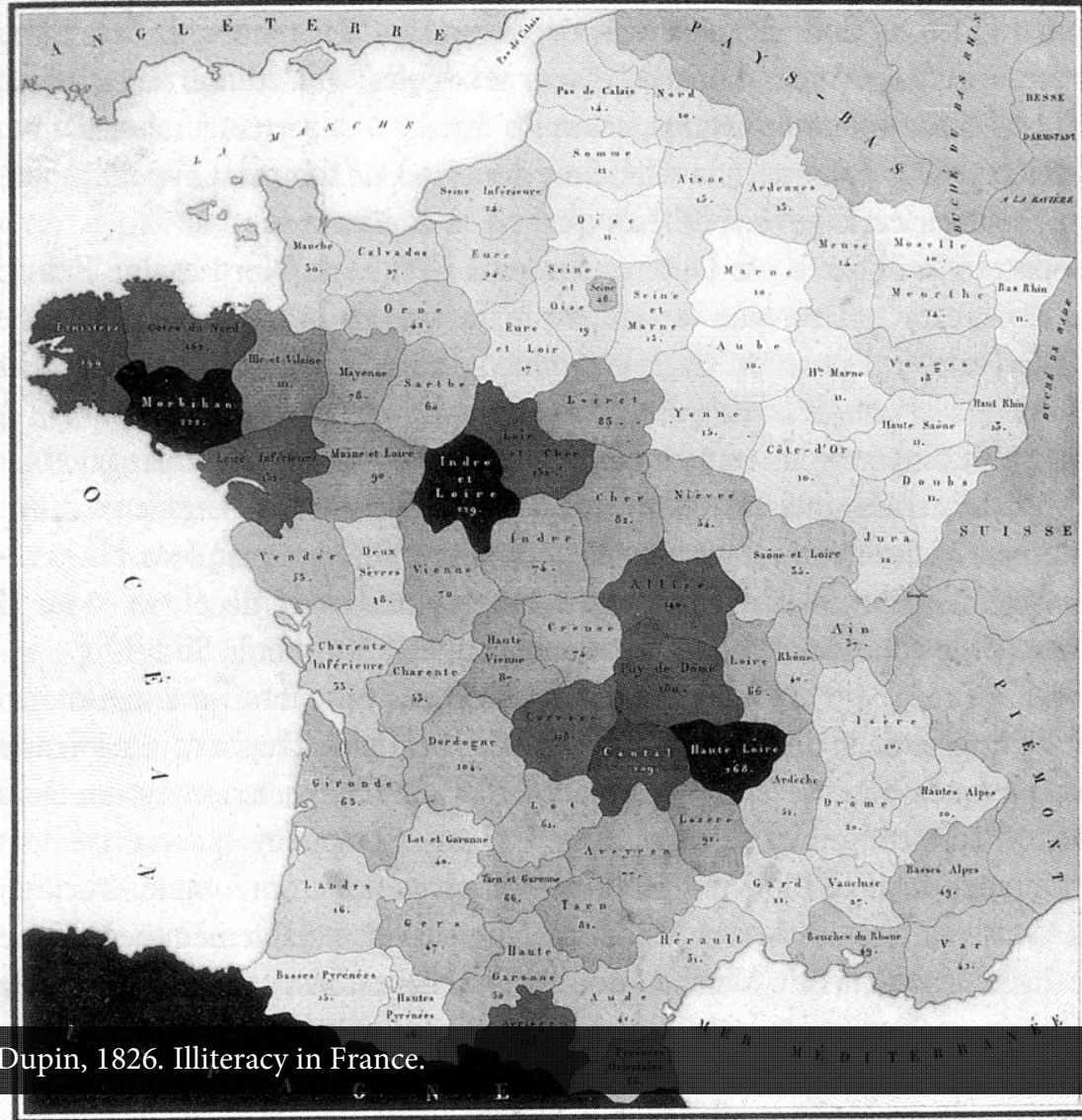


Godwin, A., Wang, Y., & Stasko, J. T. TypoTweet Maps: Characterizing Urban Areas through Typographic Social Media Visualization.



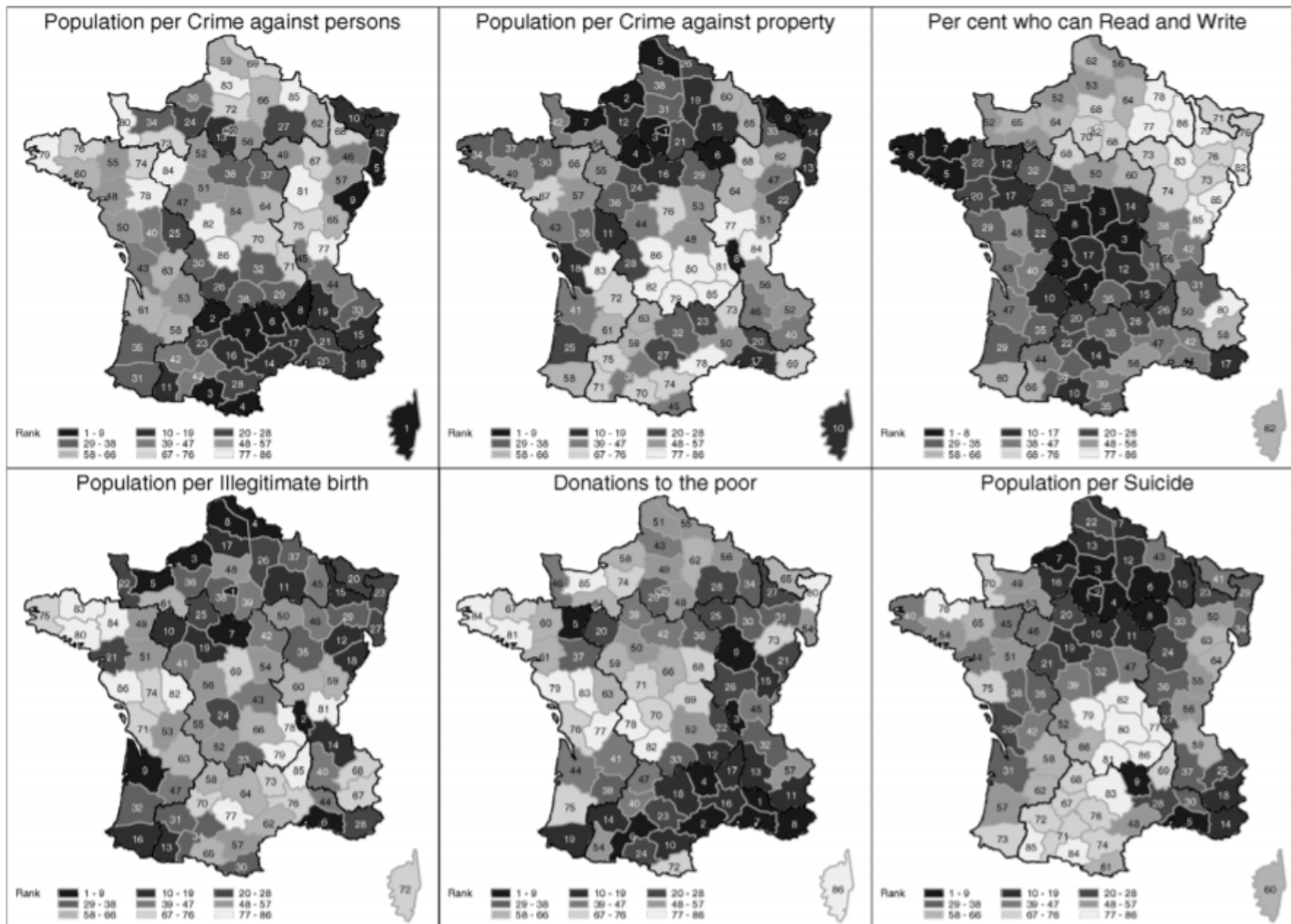
Choropleth

CARTE FIGURATIVE DE L'INSTRUCTION POPULAIRE DE LA FRANCE.

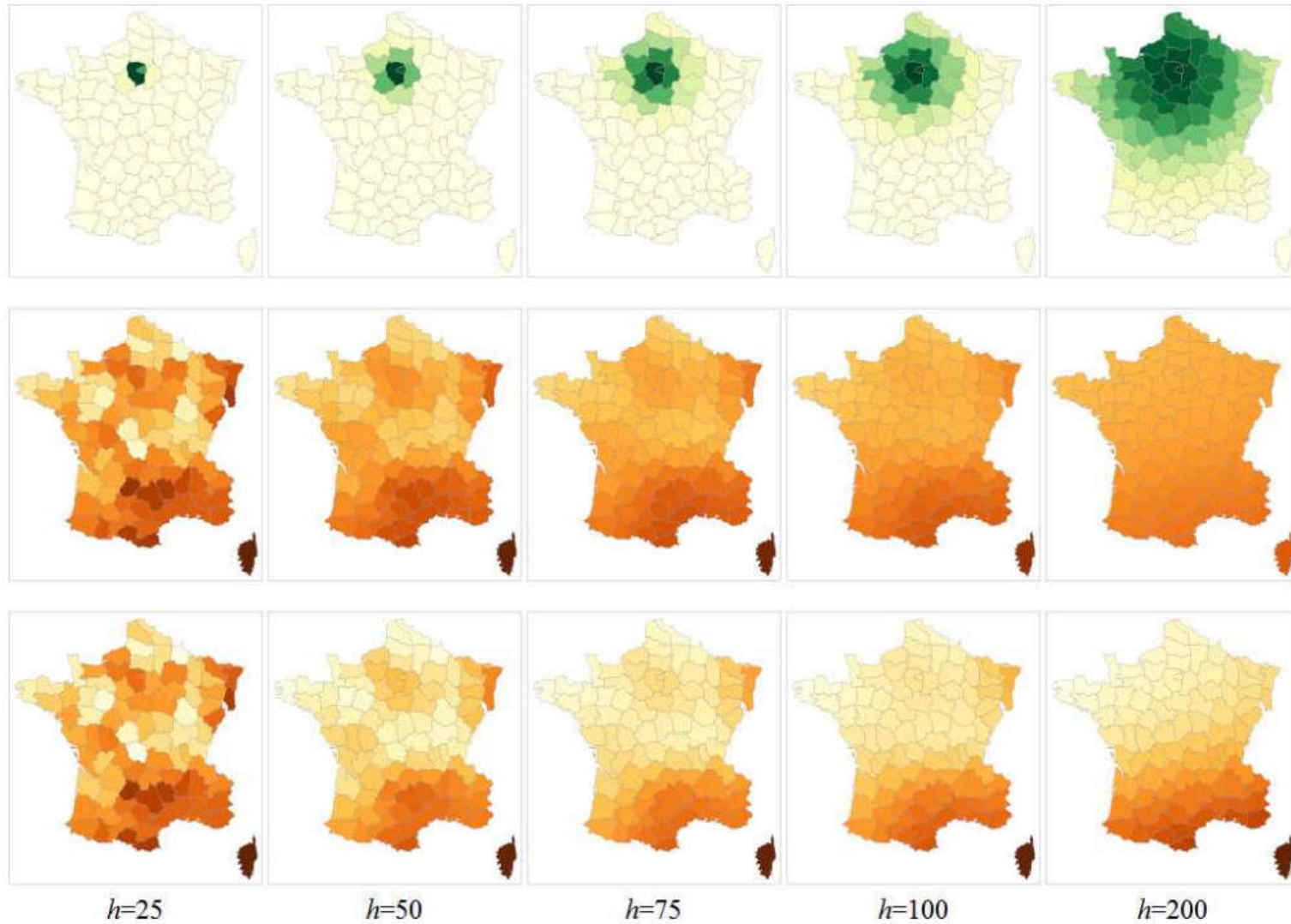


First Choropleth Map by Charles Dupin, 1826. Illiteracy in France.

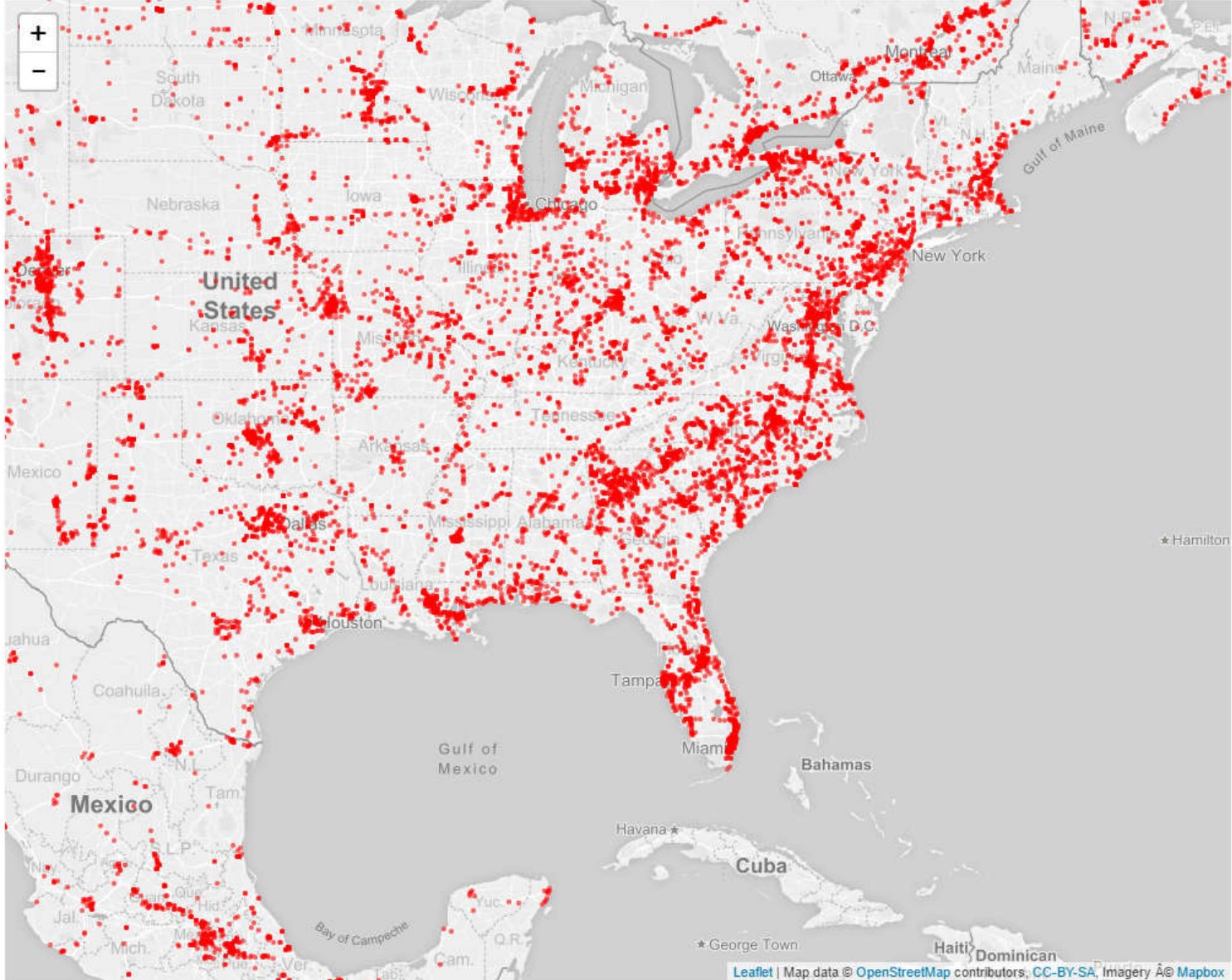


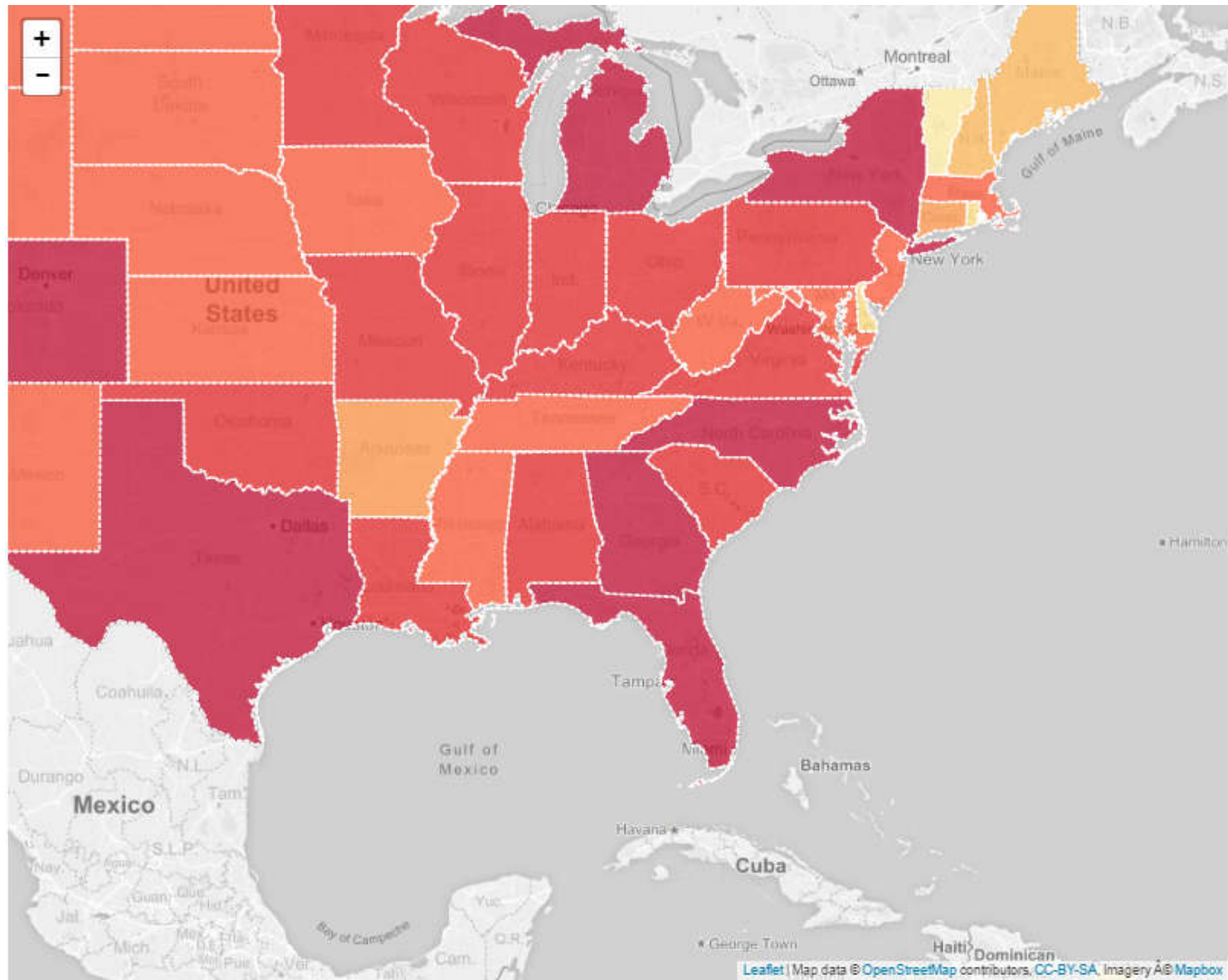


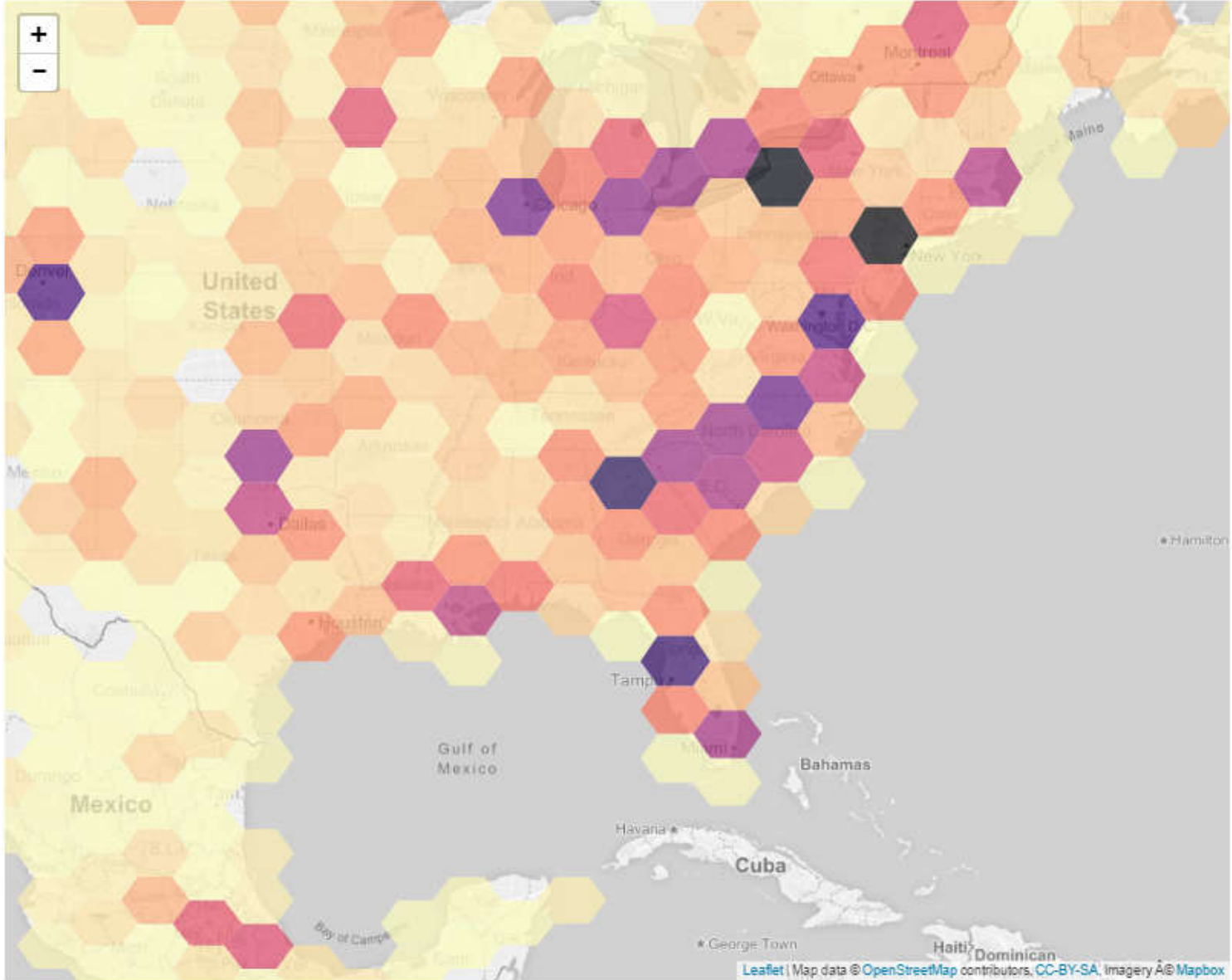
Friendly, M. (2007). A.-M. Guerry's "Moral Statistics of France": Challenges for Multivariable Spatial Analysis. *Statistical Science*, 368-399.



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



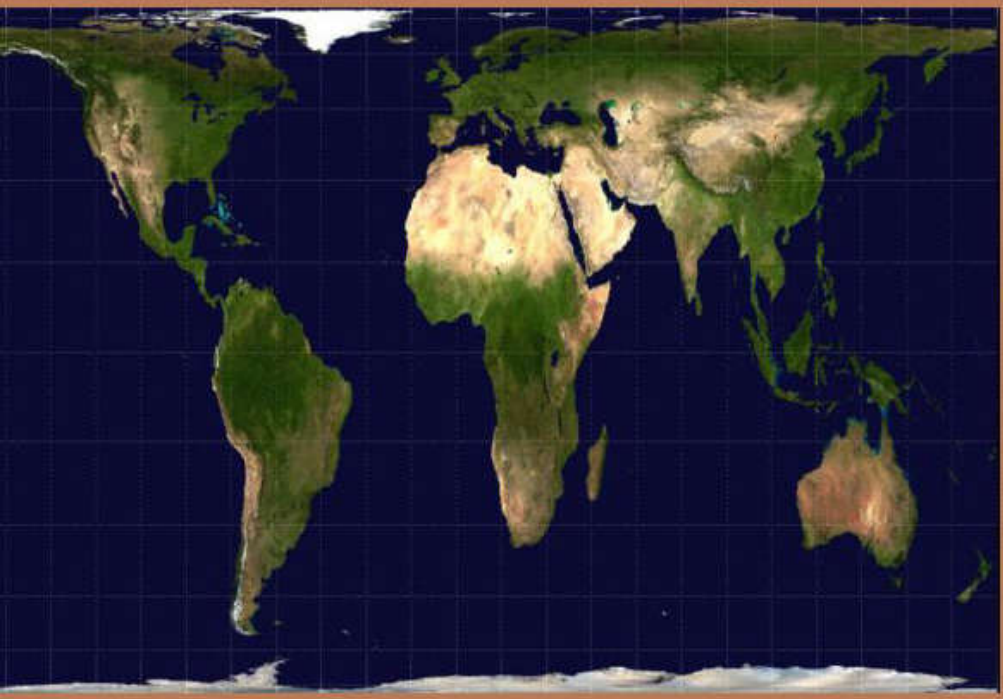




# Cartograms

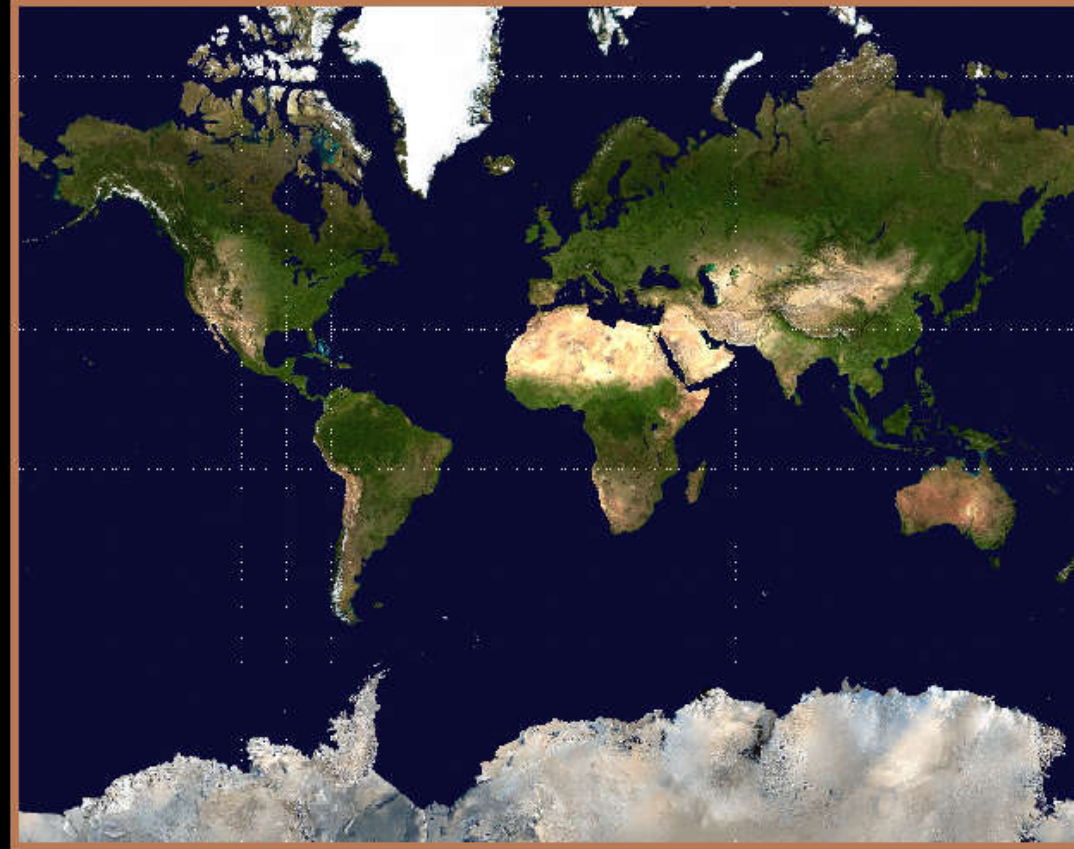


The West Wing, Gall-Peters Projections. [<https://www.youtube.com/watch?v=vVX-PrBRtTY>]



## **Peters Projection**

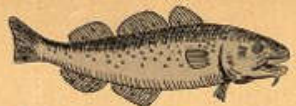
The true representaiton of land area  
(the "size" of continents and countries)



## **Mercator Projection**

Incorrect/false representation of land area





This MAP Presents  
**A BOSTONIAN'S  
 IDEA of  
 THE UNITED STATES  
 OF AMERICA**

Copyright by Daniel K. Wallingford, 452 West 144th Street, New York

A person born in the city of BOSTON and residing in BOSTON may not be a BOSTONIAN; yet a person born in Hingham, residing in Newton (dilatatory domicile; Magnolia-frequent crossings to England and the Continent), is likely to be a BOSTONIAN. The lack of a definite text-book definition for A BOSTONIAN has added to the many difficulties encountered by the Publishers of this map . . . The ideas held by many BOSTONIANS concerning THE UNITED STATES have been gathered, evaluated, weighted, and combined. This map, a composite of these ideas, is the result . . .

**Universities\***  
 HARVARD  
 WILLIAM AND MARY  
 YALE  
 PRINCETON  
 COLUMBIA

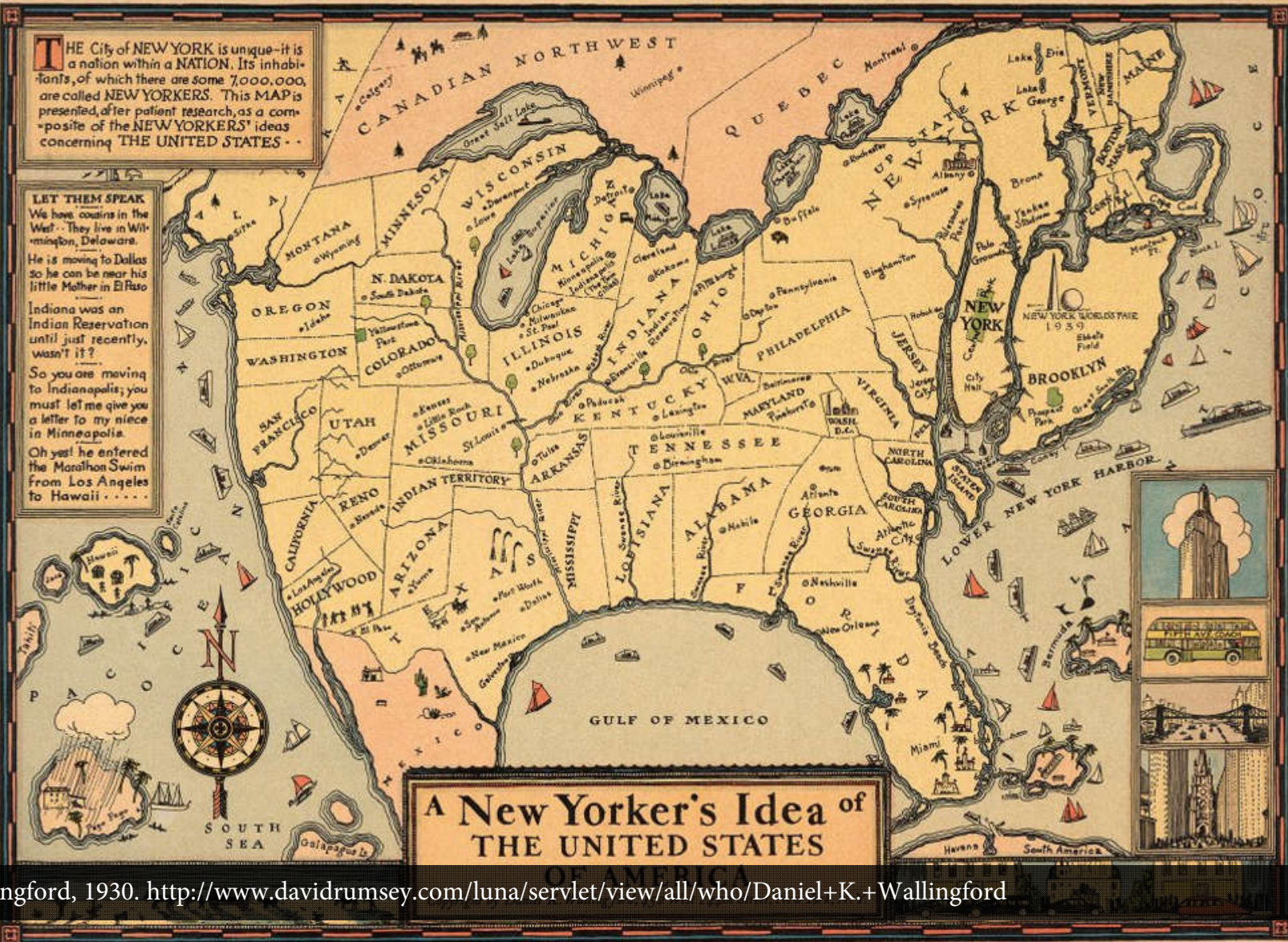
\*Note: Since this list was compiled many more universities and colleges have been founded including schools of Theology, Technology, Music, Art, Commerce, etc. Institutions of learning abound in all, especially in and near BOSTON. There are also several excellent schools located in the WEST.



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

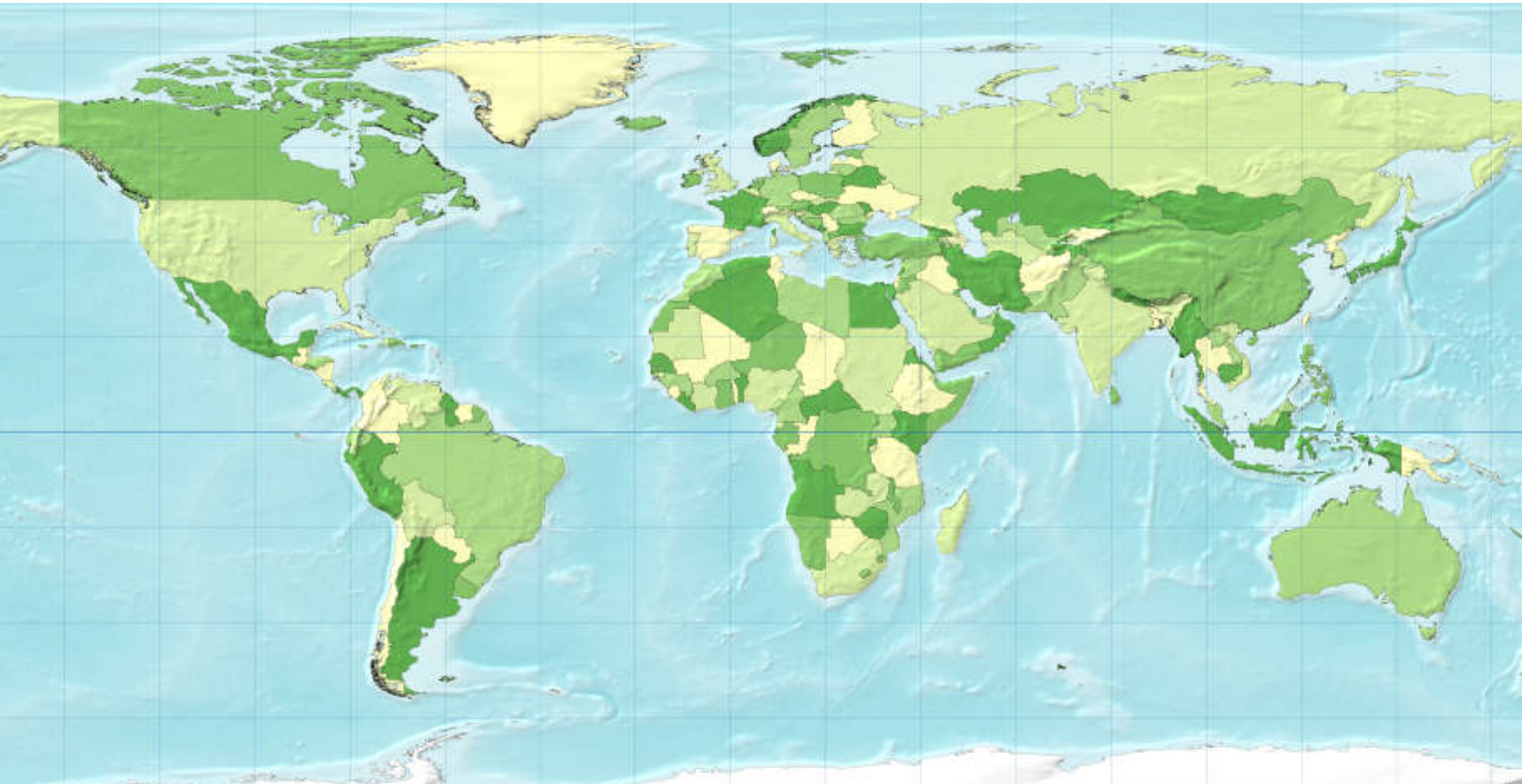
**T**HE City of NEW YORK is unique—it is a nation within a NATION. Its inhabitants, of which there are some 7,000,000, are called NEW YORKERS. This MAP is presented, after patient research, as a composite of the NEW YORKERS' ideas concerning THE UNITED STATES . . .

**LET THEM SPEAK**  
 We have cousins in the West . . . They live in Wilmington, Delaware.  
 He is moving to Dallas so he can be near his little Mother in El Paso . . .  
 Indiana was an Indian Reservation until just recently, wasn't it?  
 So you are moving to Indianapolis; you must let me give you a letter to my niece in Minneapolis.  
 Oh yes! he entered the Marathon Swim from Los Angeles to Hawaii . . . .



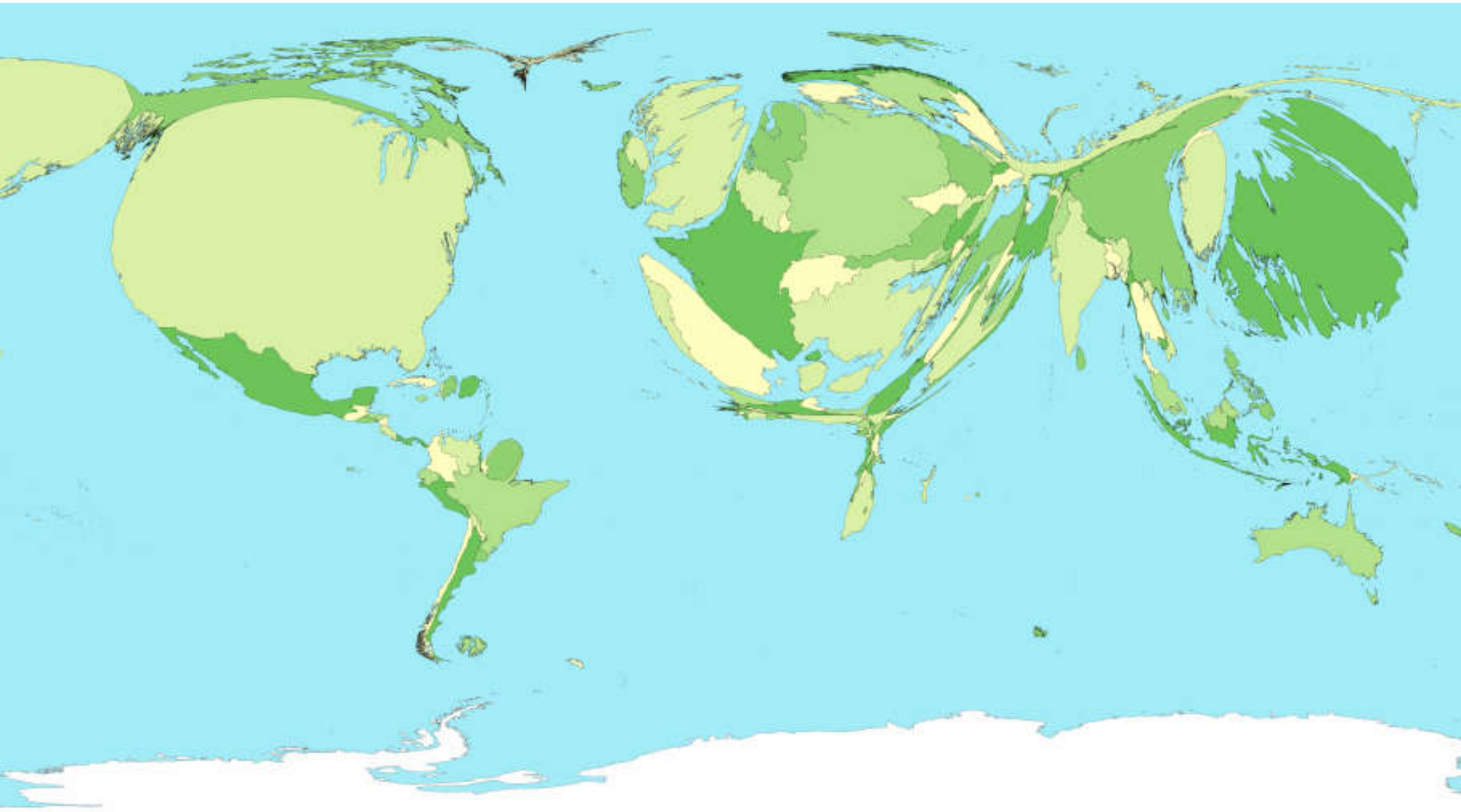
**A New Yorker's Idea of THE UNITED STATES**

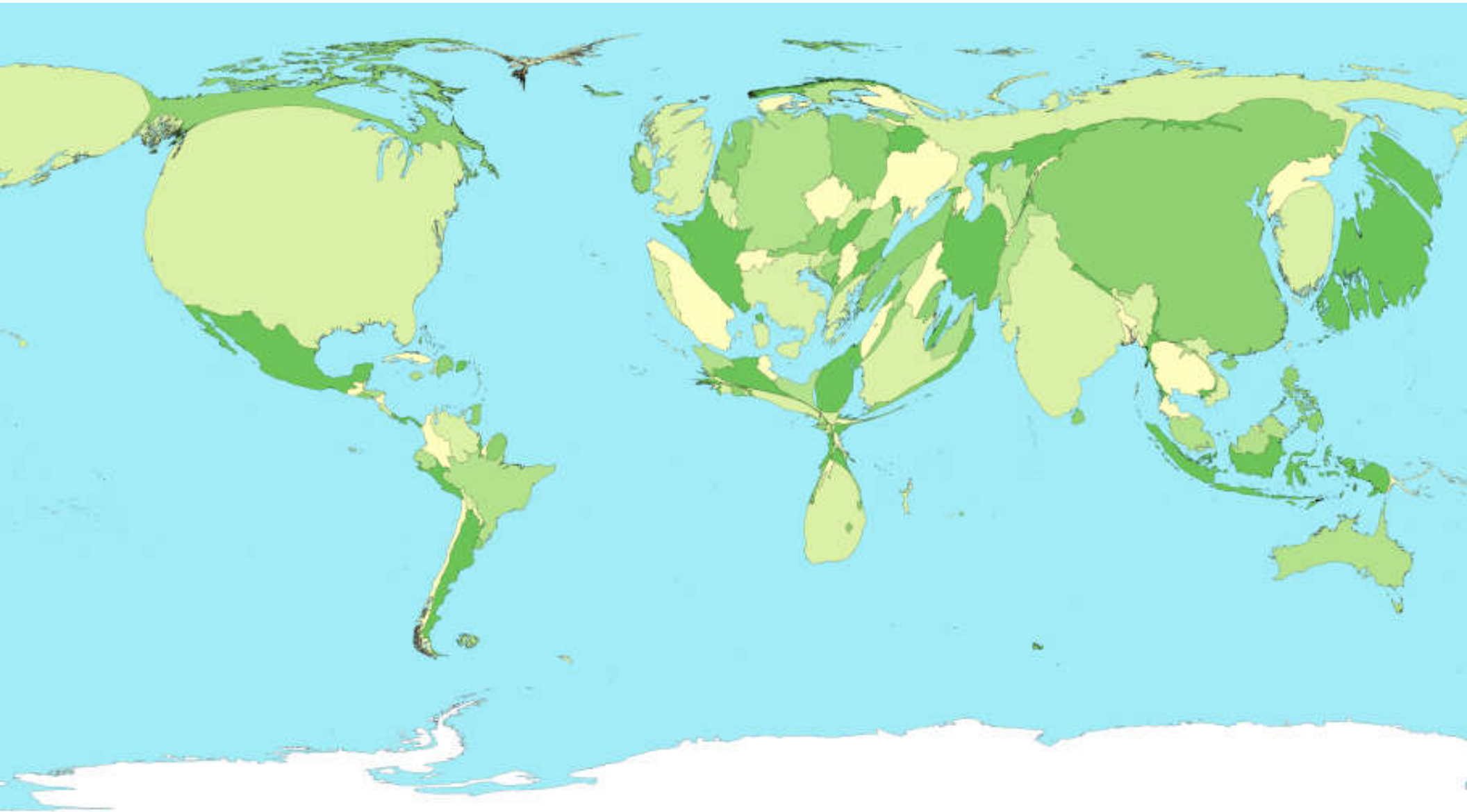
Daniel K. Wallingford, 1930. <http://www.davidrumsey.com/luna/servlet/view/all/who/Daniel+K.+Wallingford>

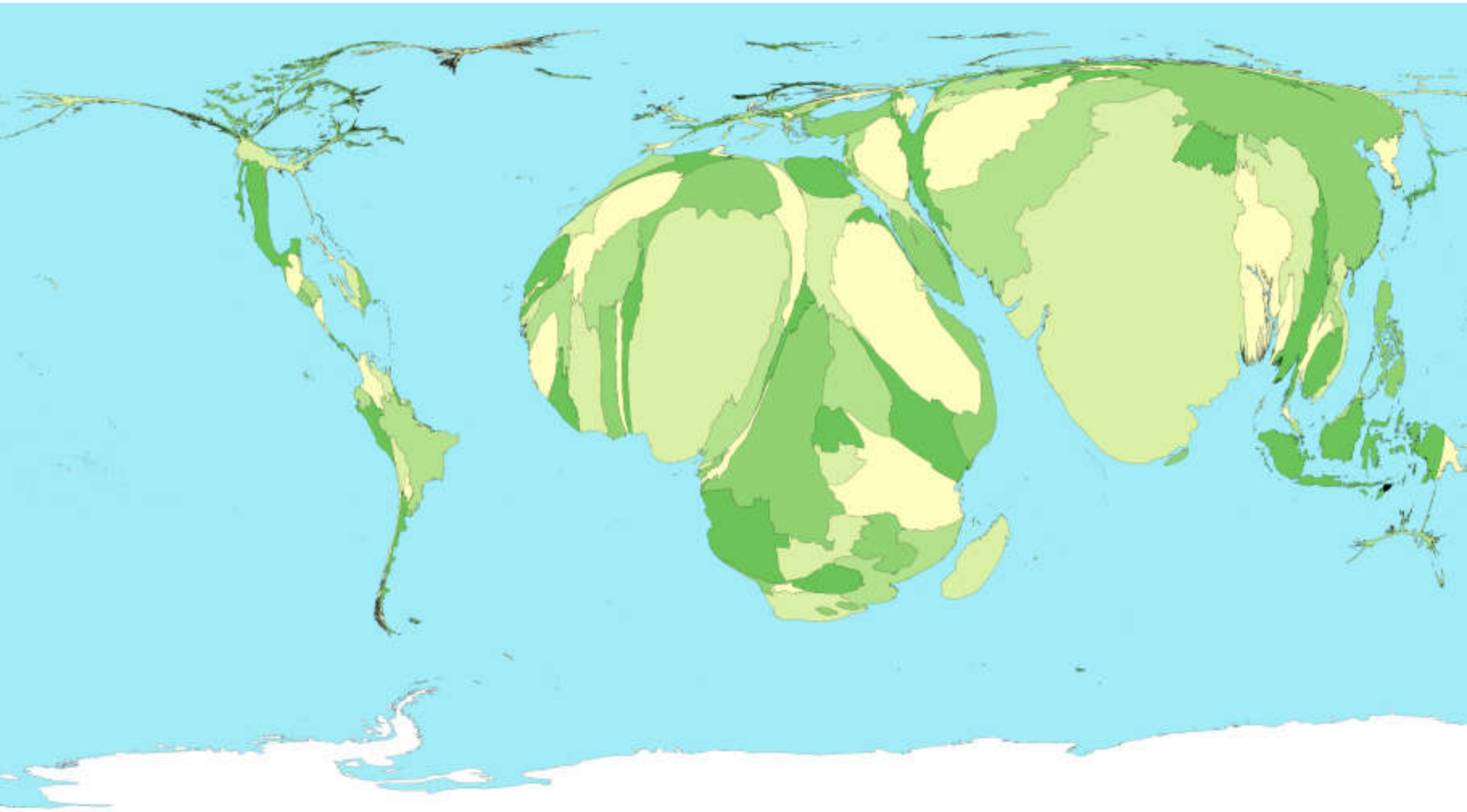


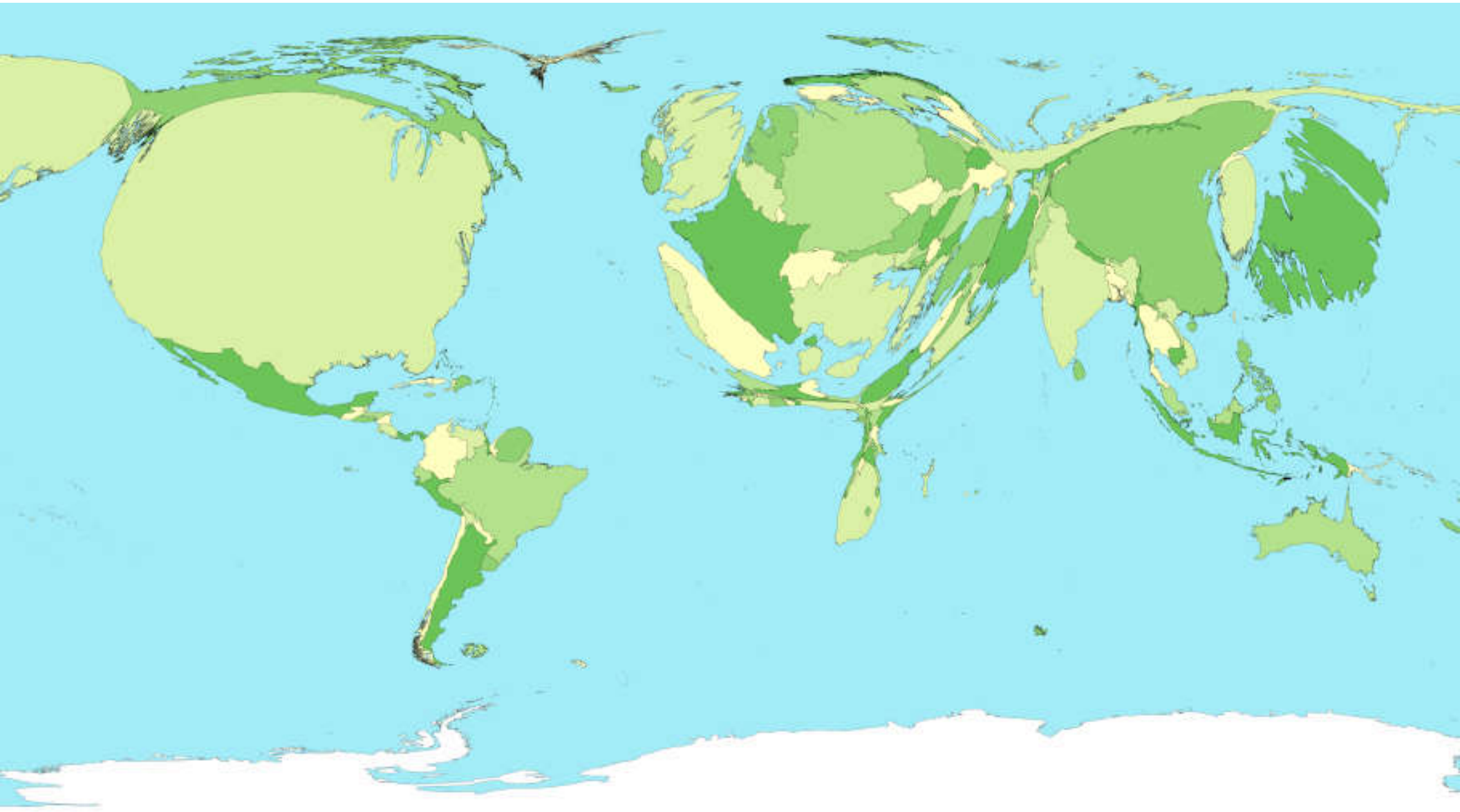
Newman, M. 2006. Images of the Social and Economic World [<http://www-personal.umich.edu/~mejn/cartograms/>]



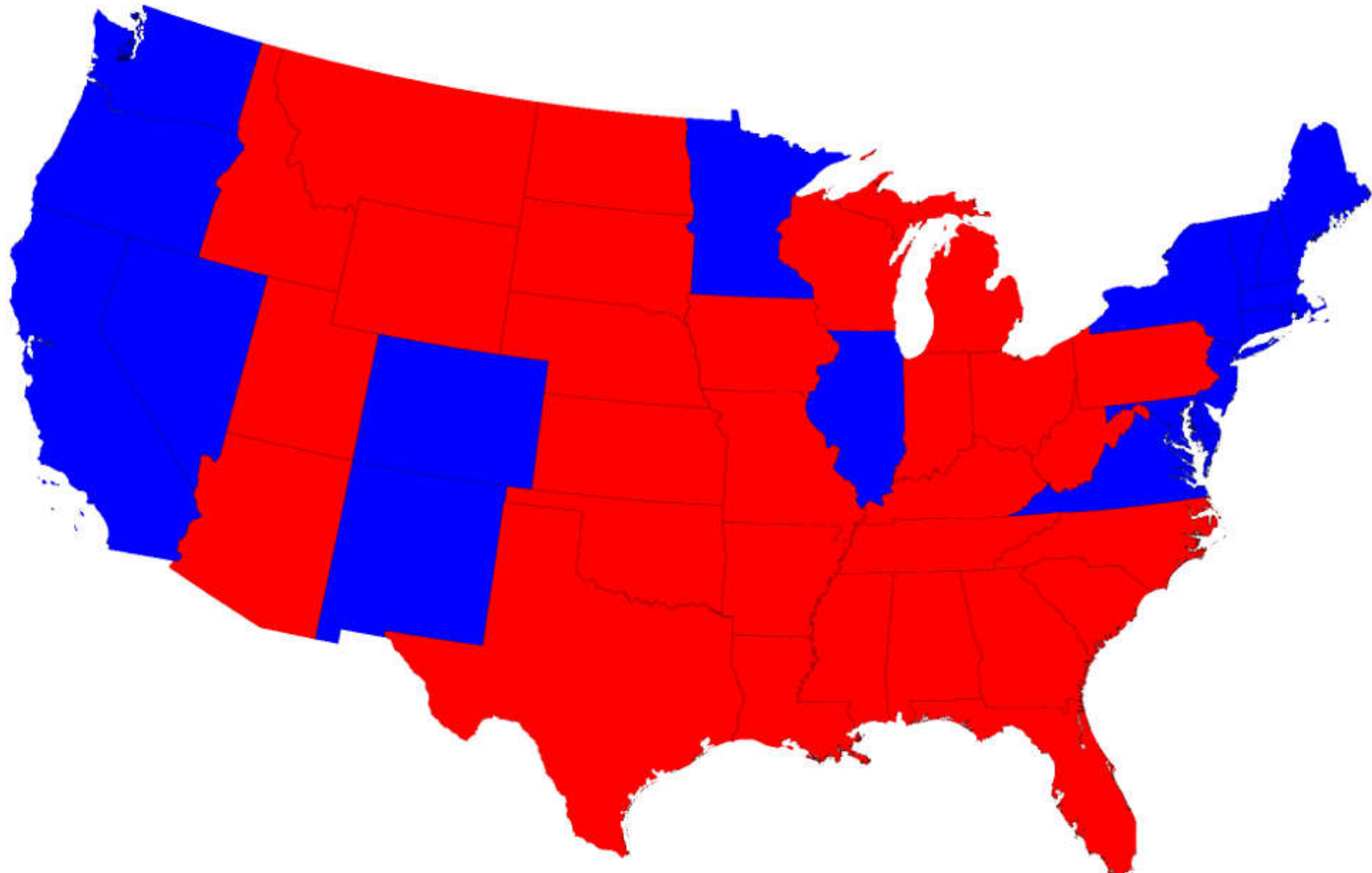




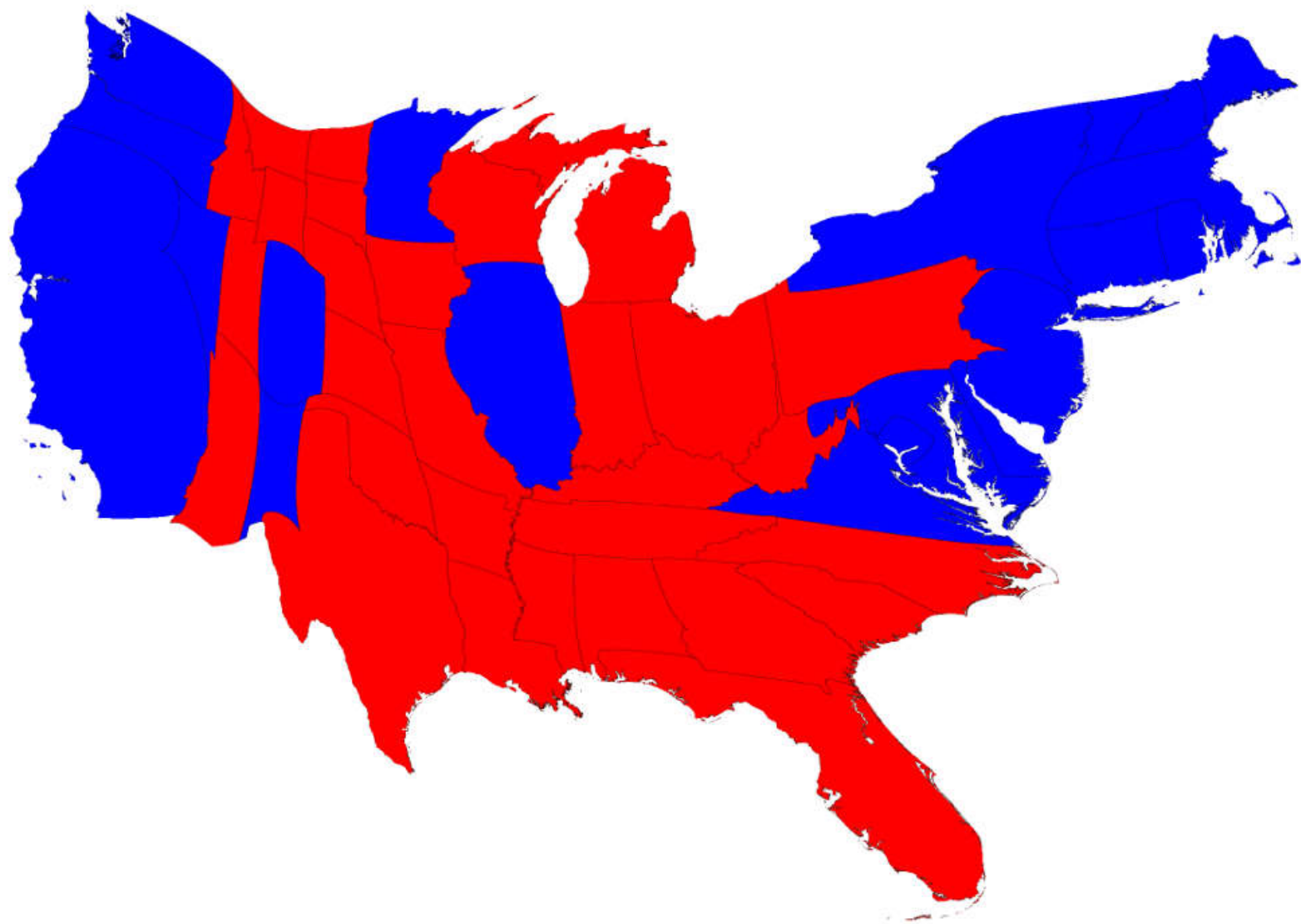


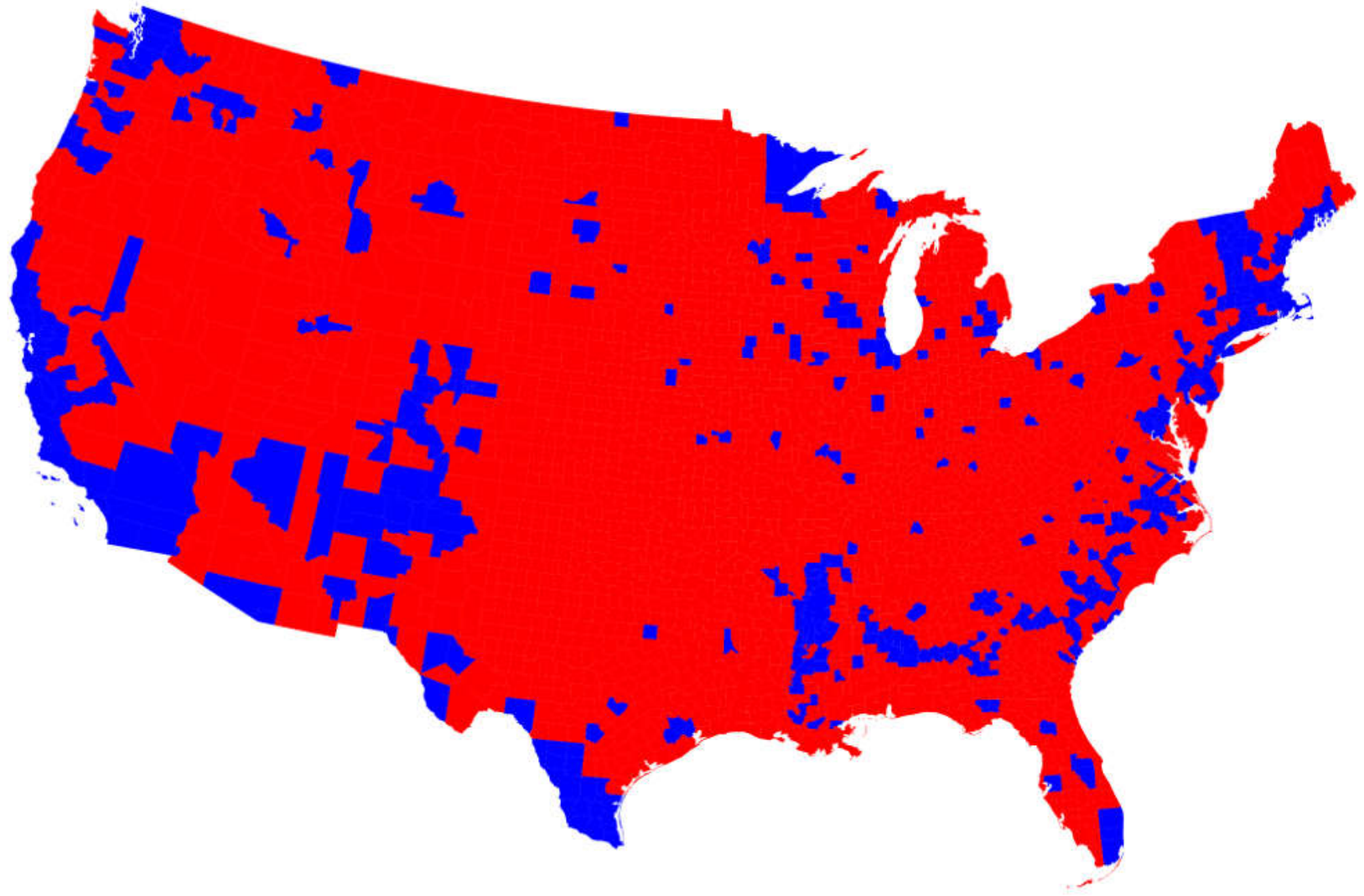


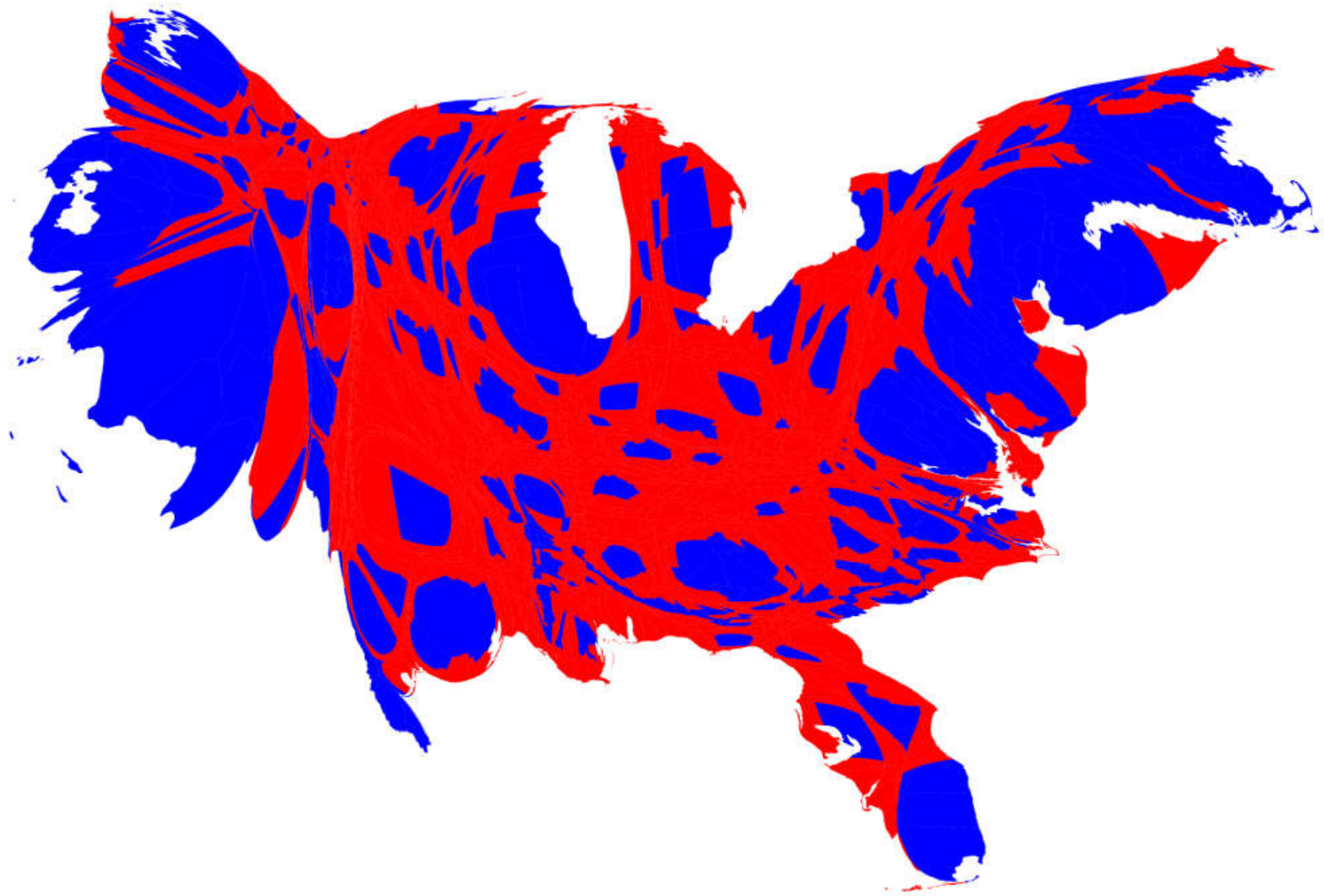


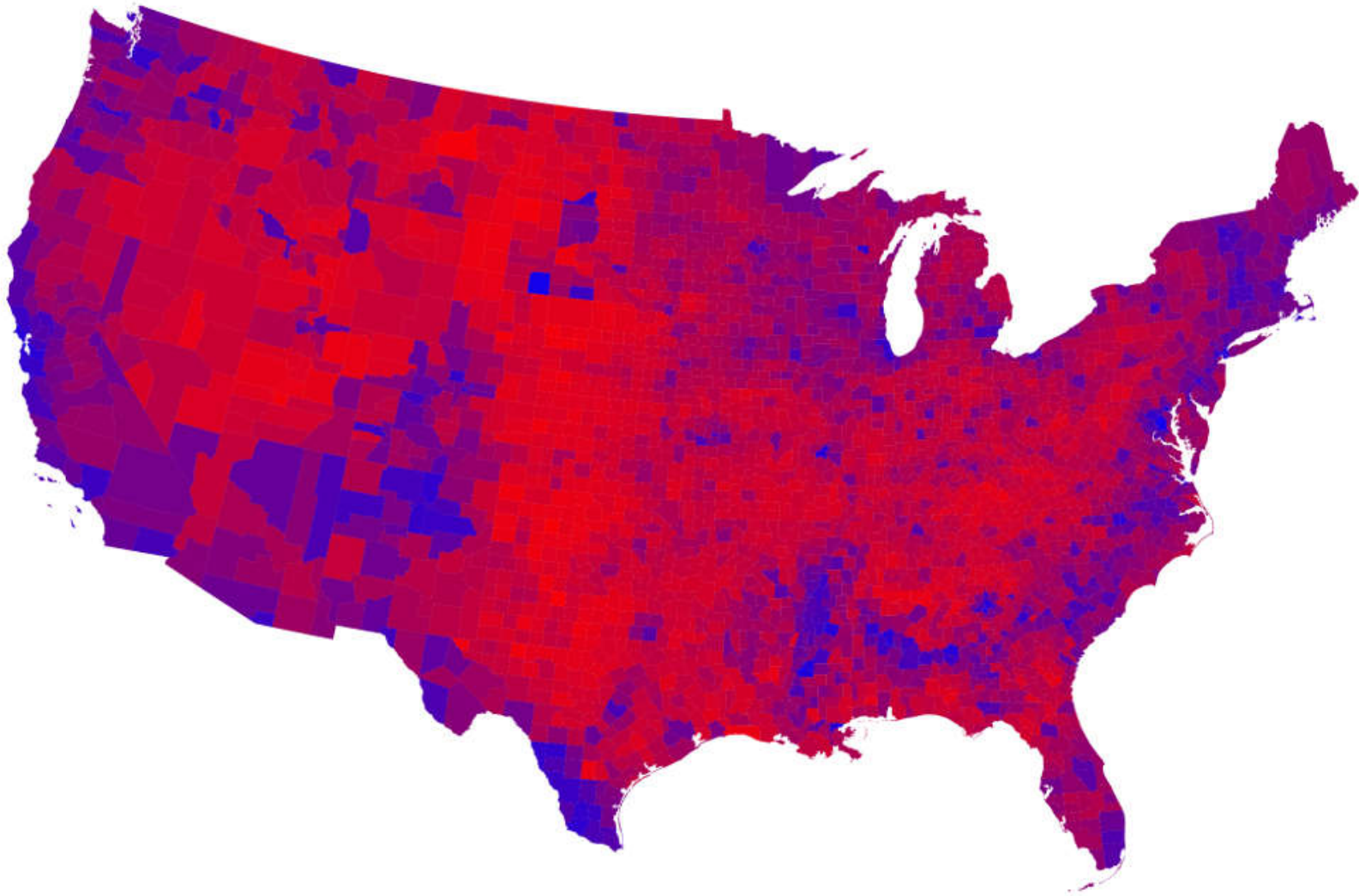


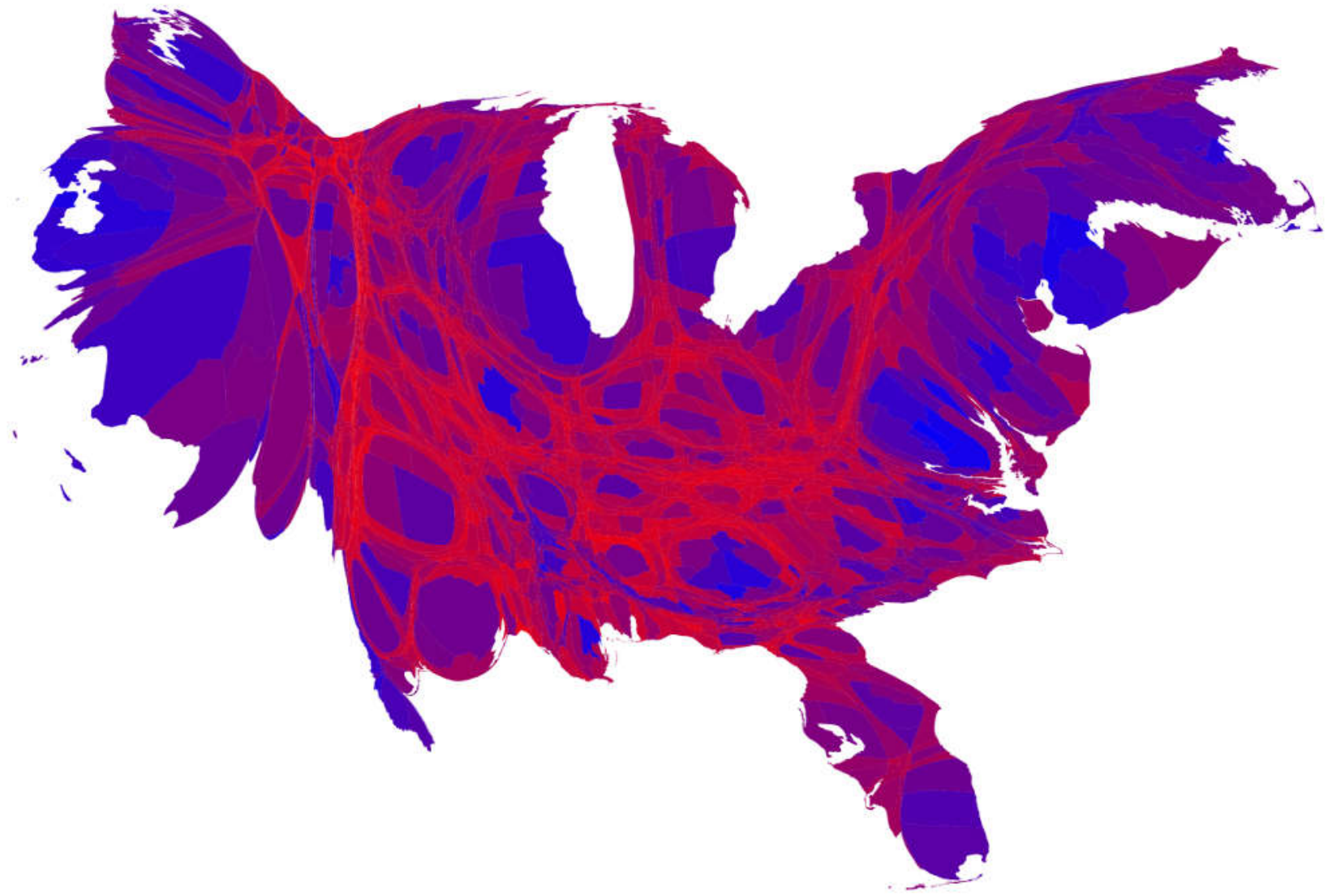
Newman, M. 2016. Maps of the 2016 US Presidential Election Results. <http://www-personal.umich.edu/~mejn/election/2016/>











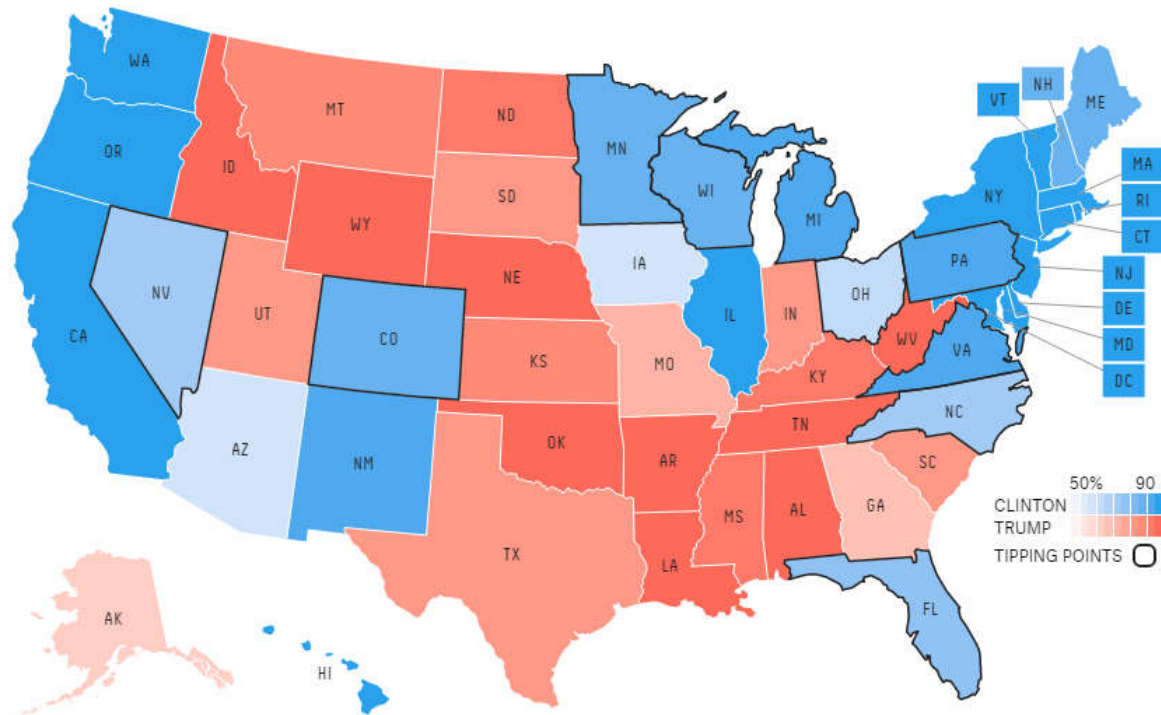
### Chance of winning

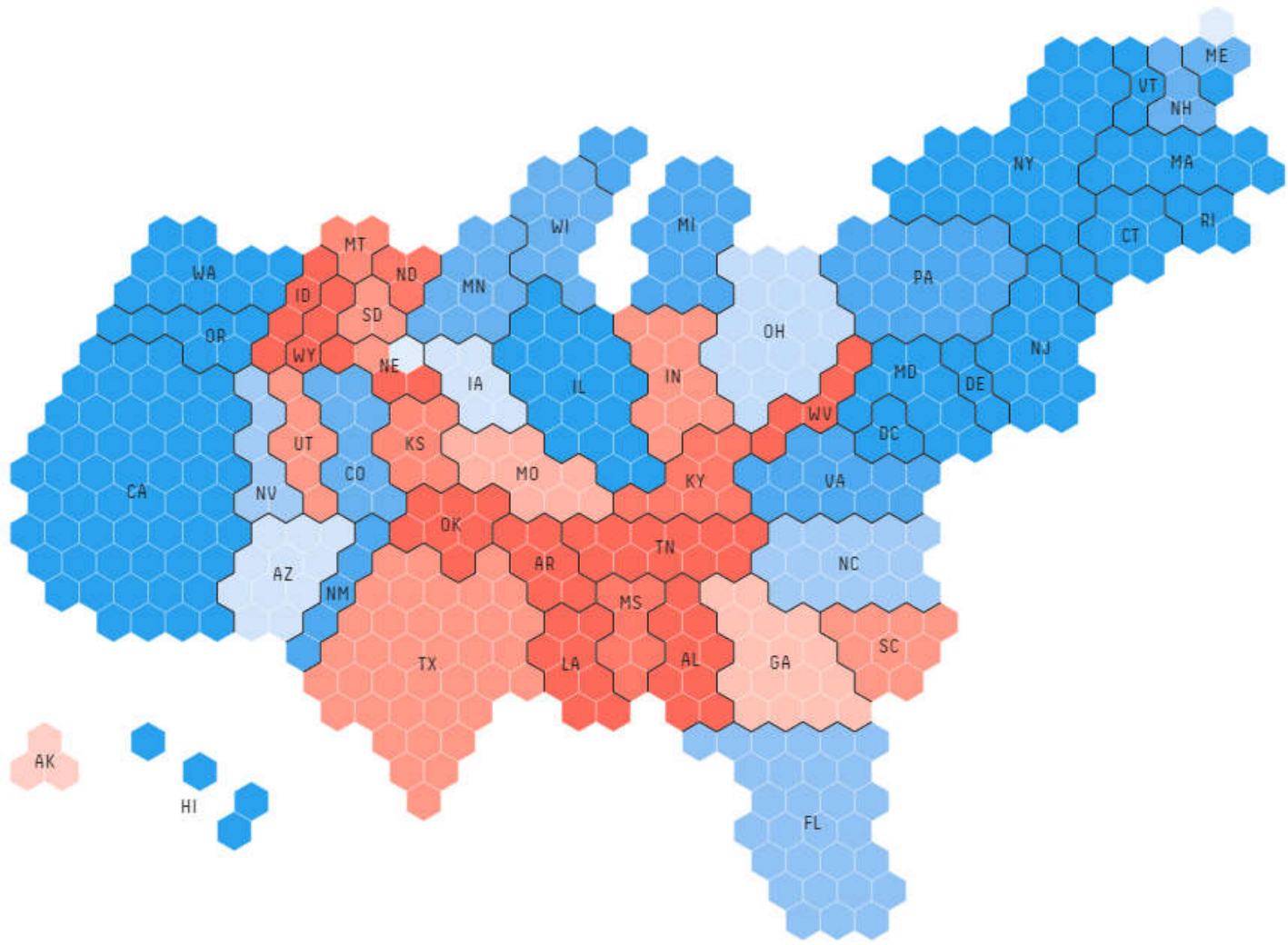


Hillary Clinton  
**88.1%**

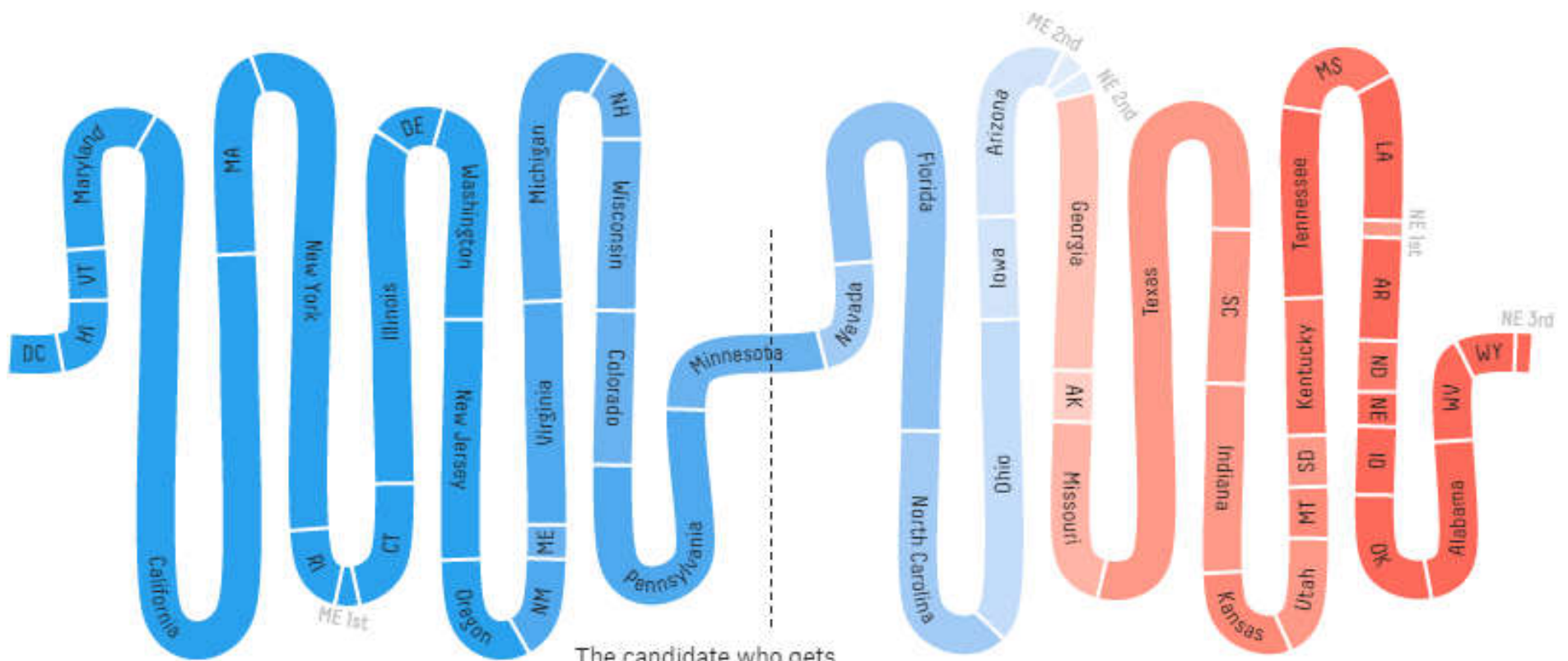


Donald Trump  
**11.9%**







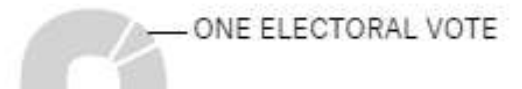


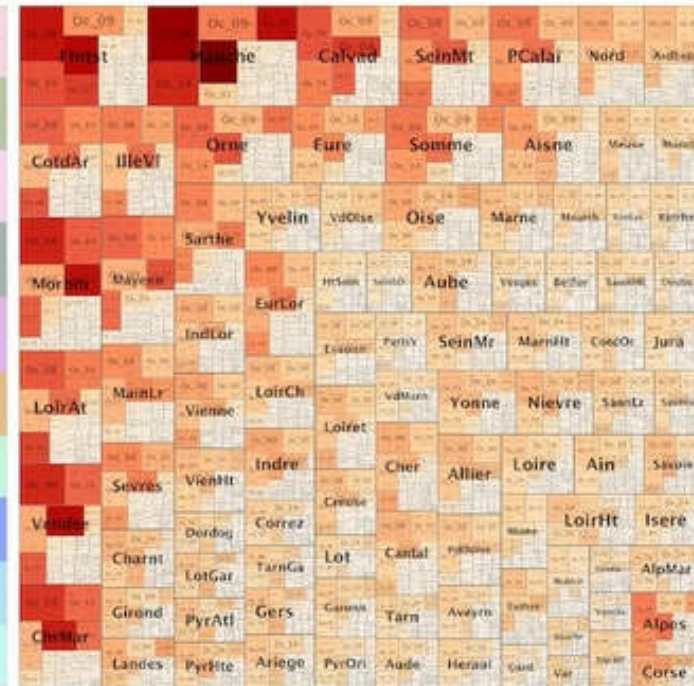
← Bigger Clinton margins

The candidate who gets more than 269 electoral votes — enough to cross this line — wins

Bigger Trump margins →

KEY





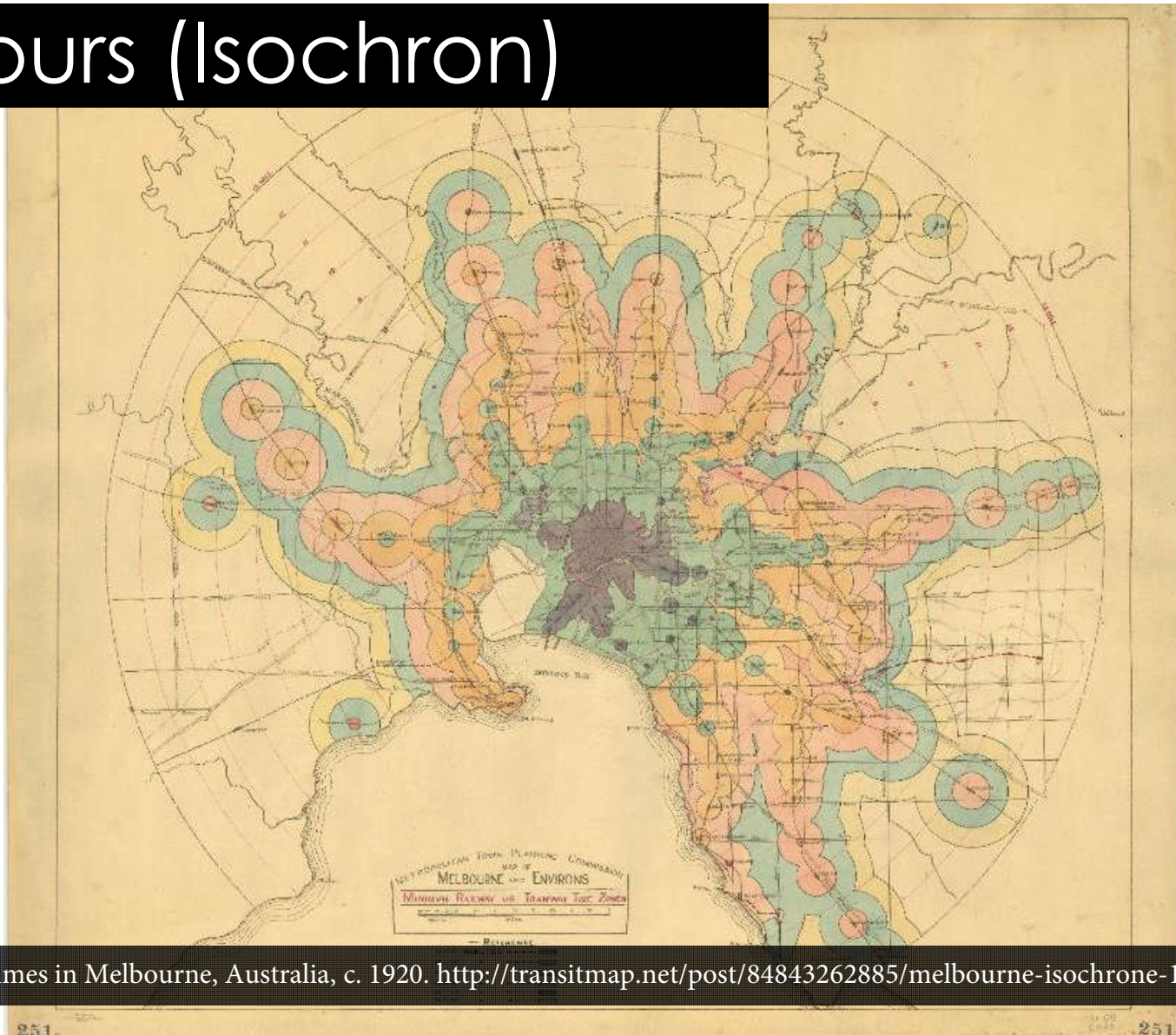
Wood, J., & Dykes, J. (2008). Spatially ordered treemaps. [IEEE TVCG]

# 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

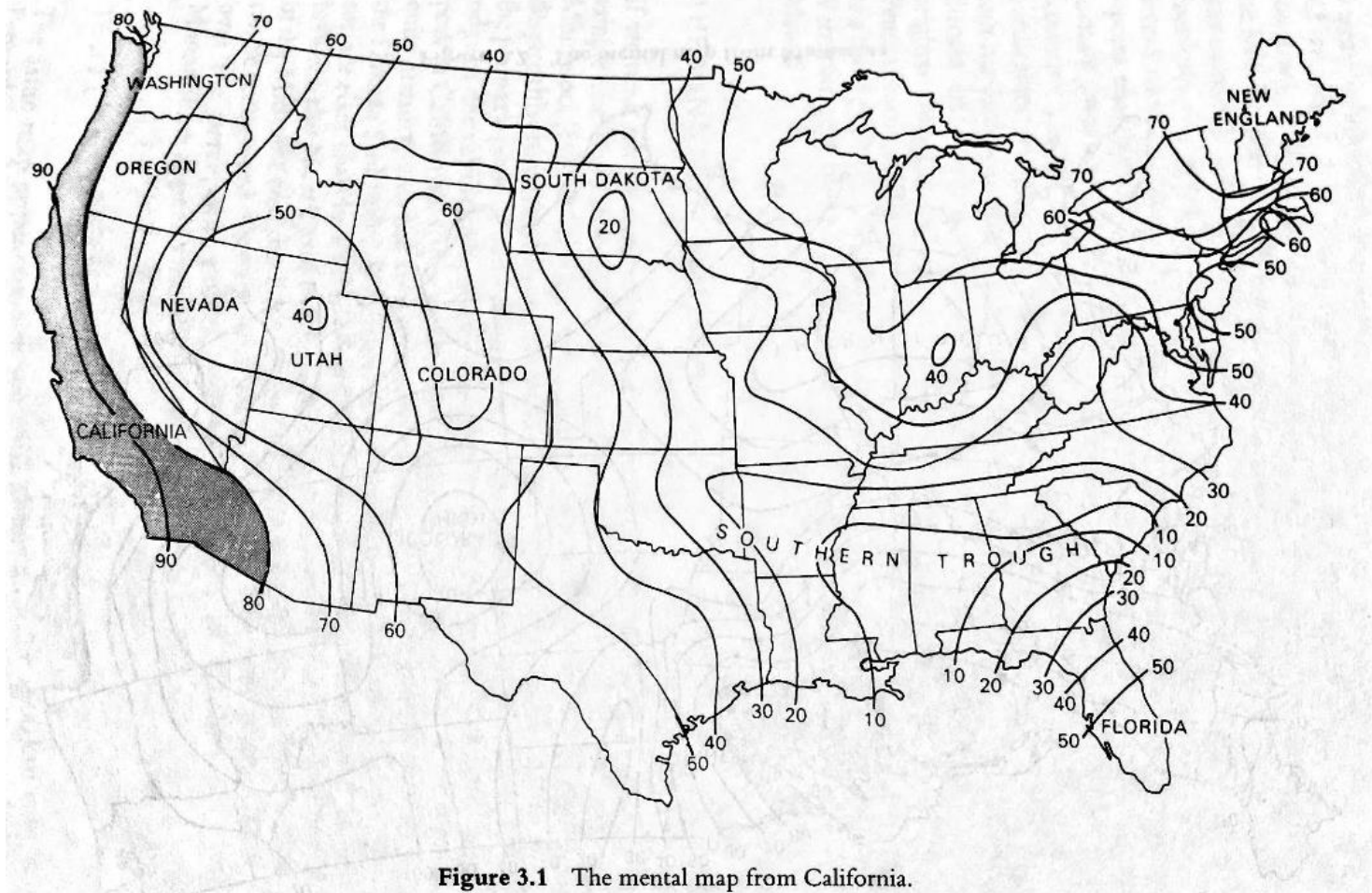
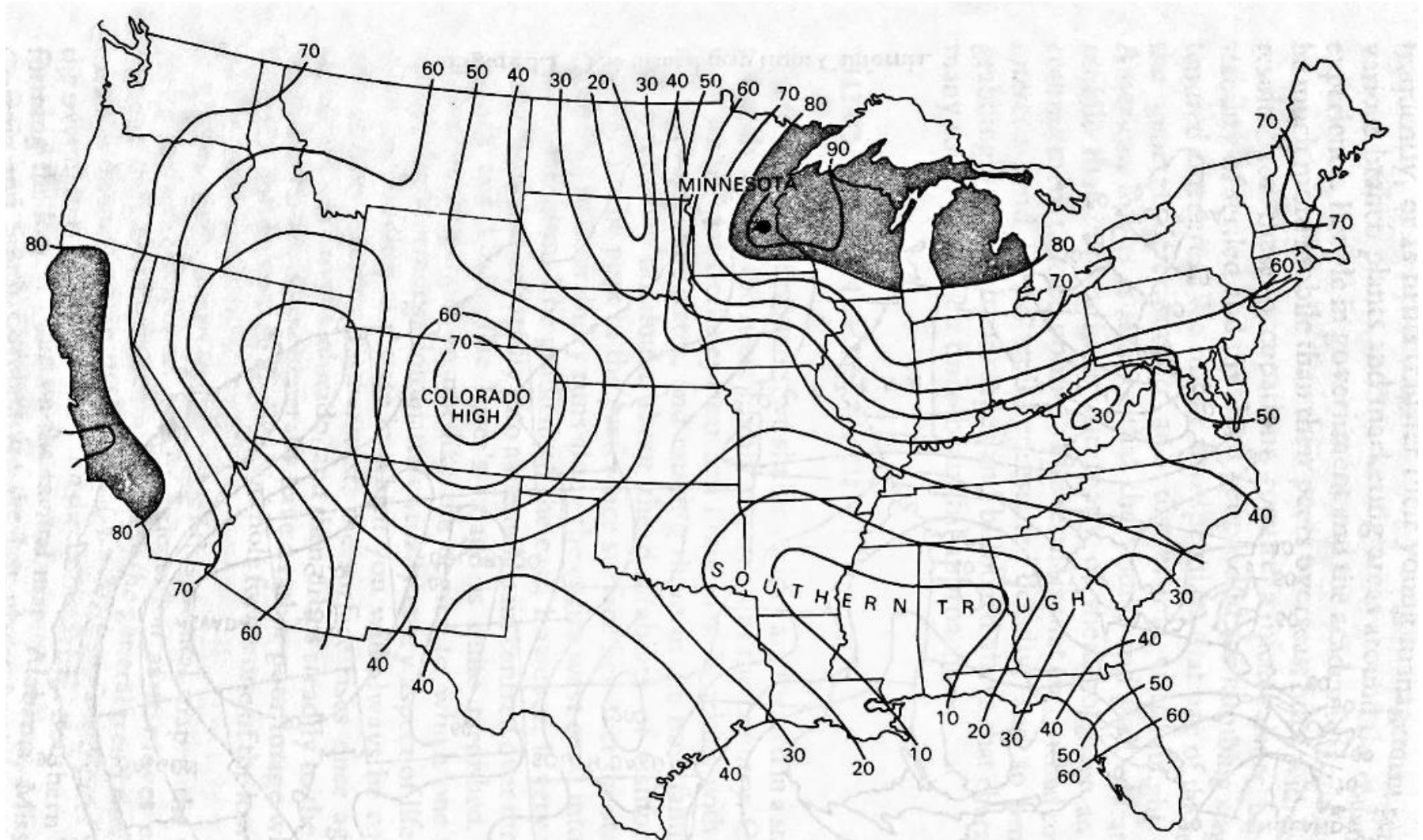
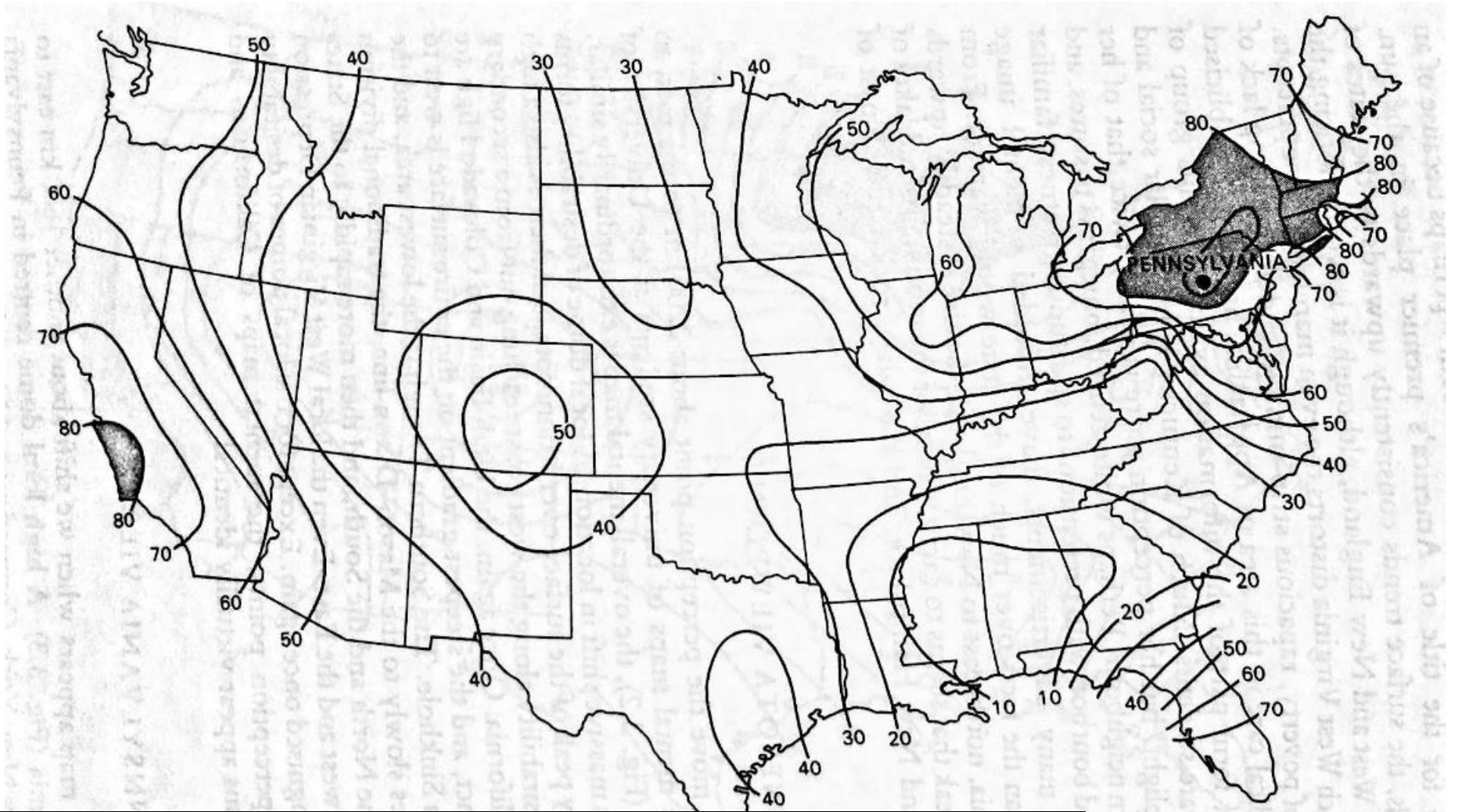


Figure 3.1 The mental map from California.

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

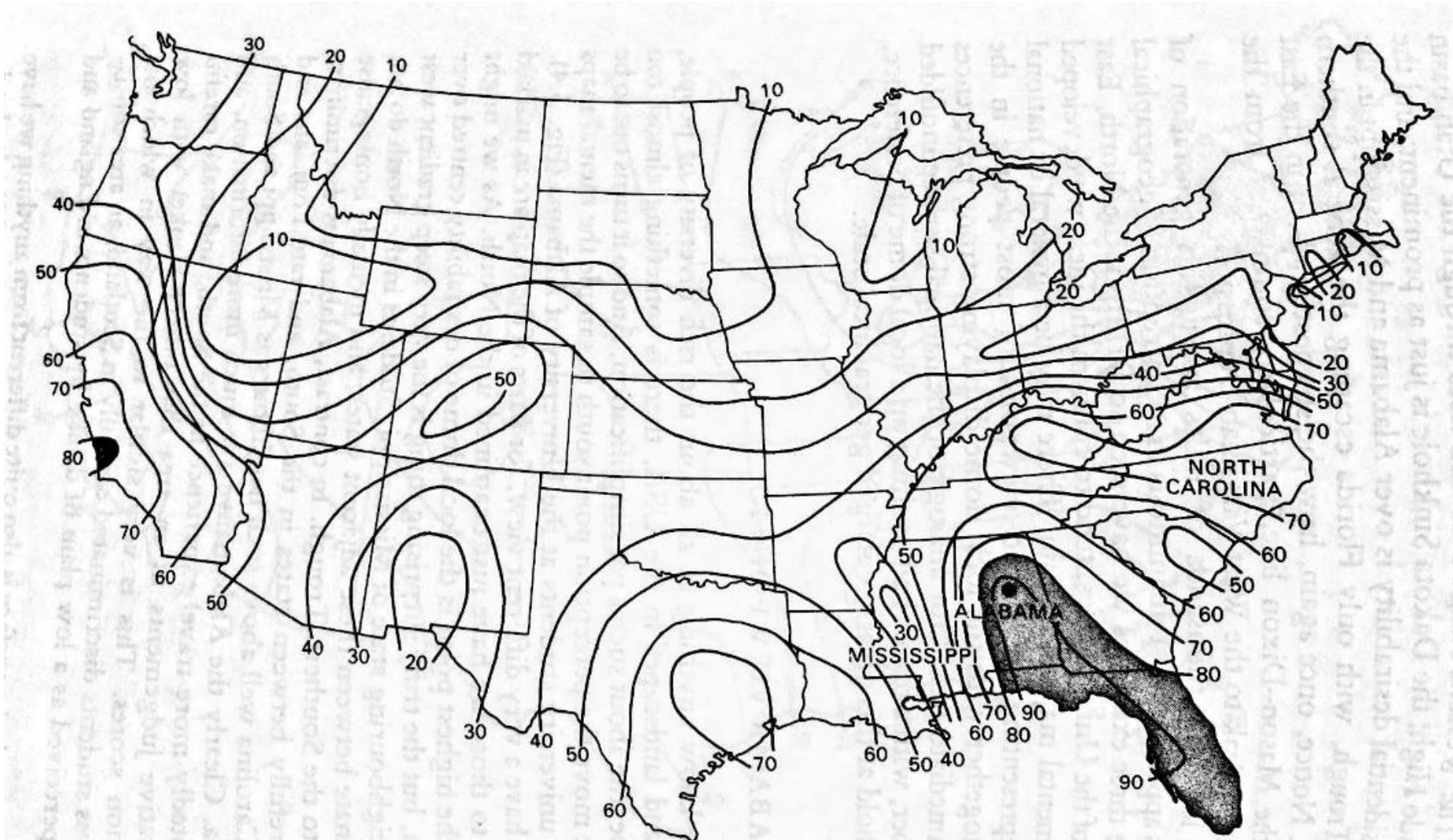


Desirability Map - Minnesota

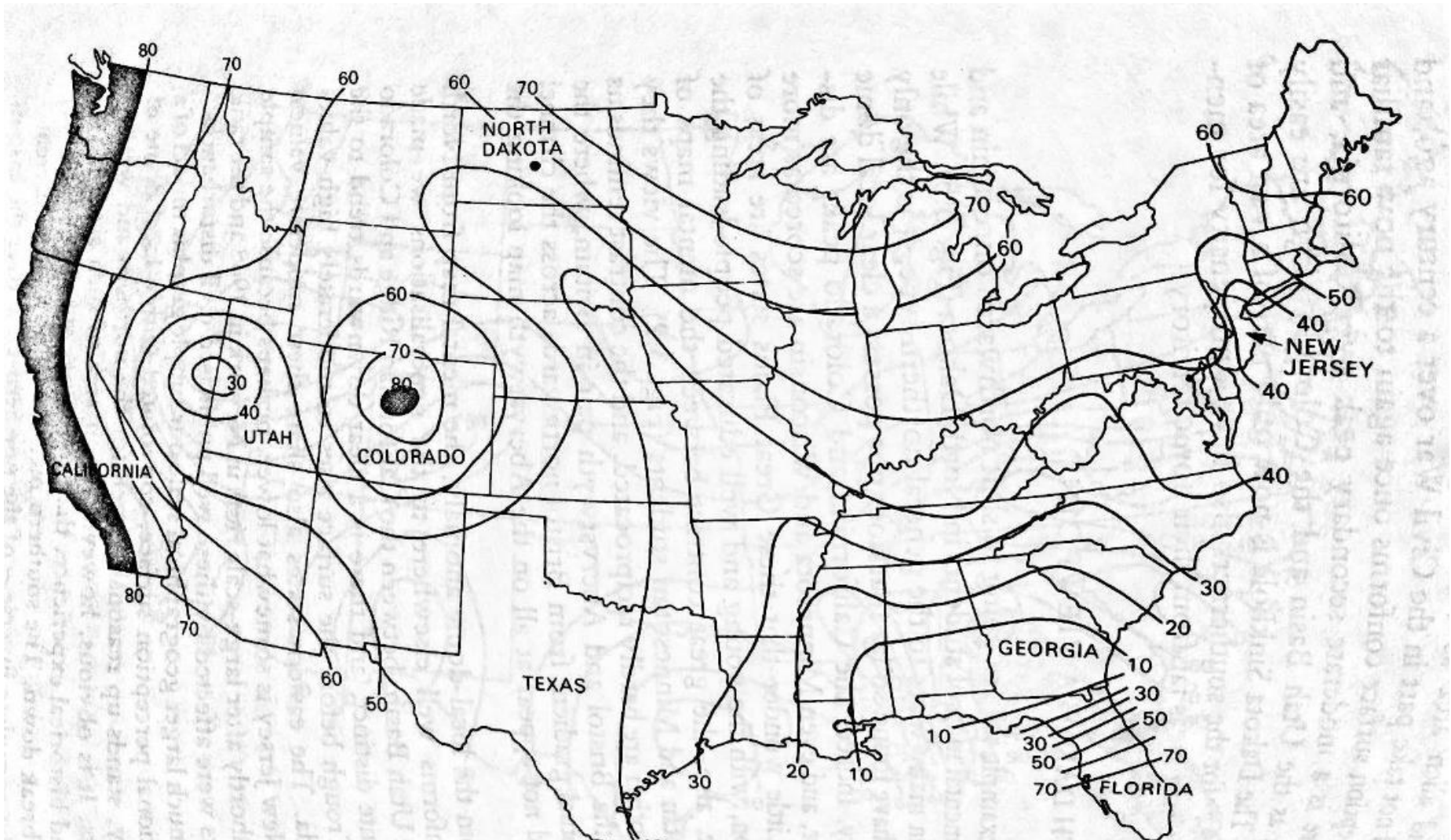


Desirability Map - Pennsylvania

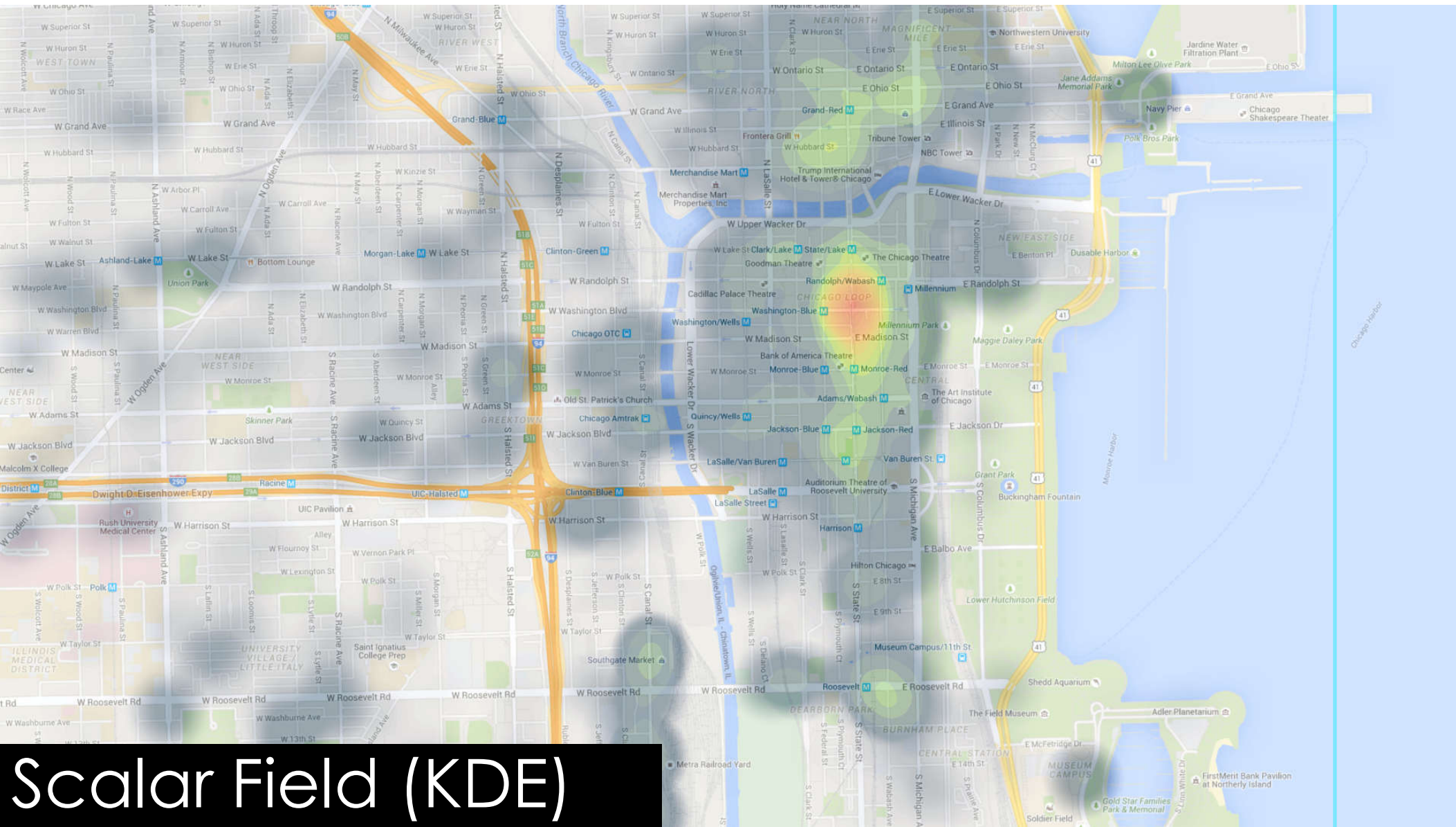




Desirability Map - Alabama

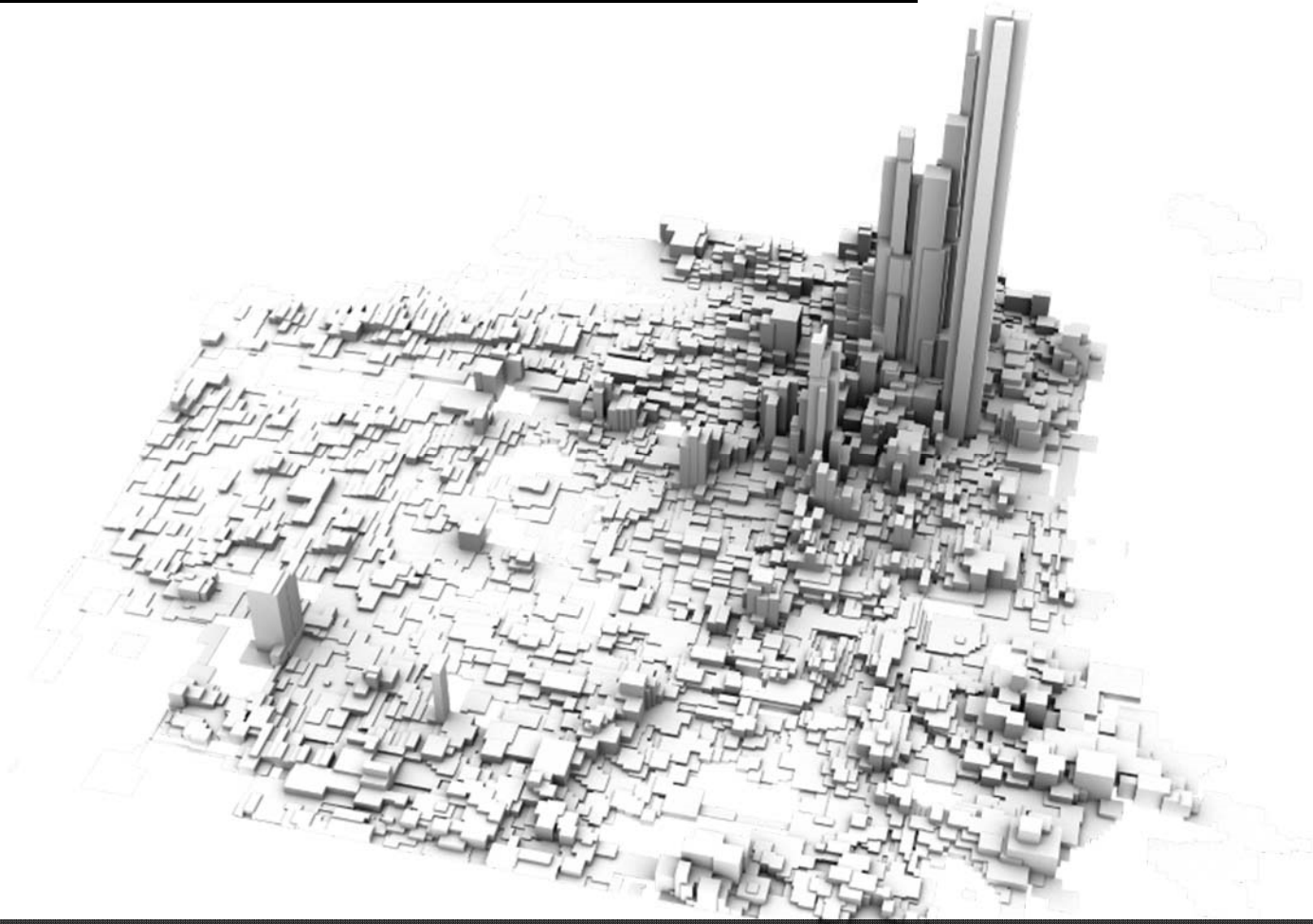


Desirability Map – North Dakota

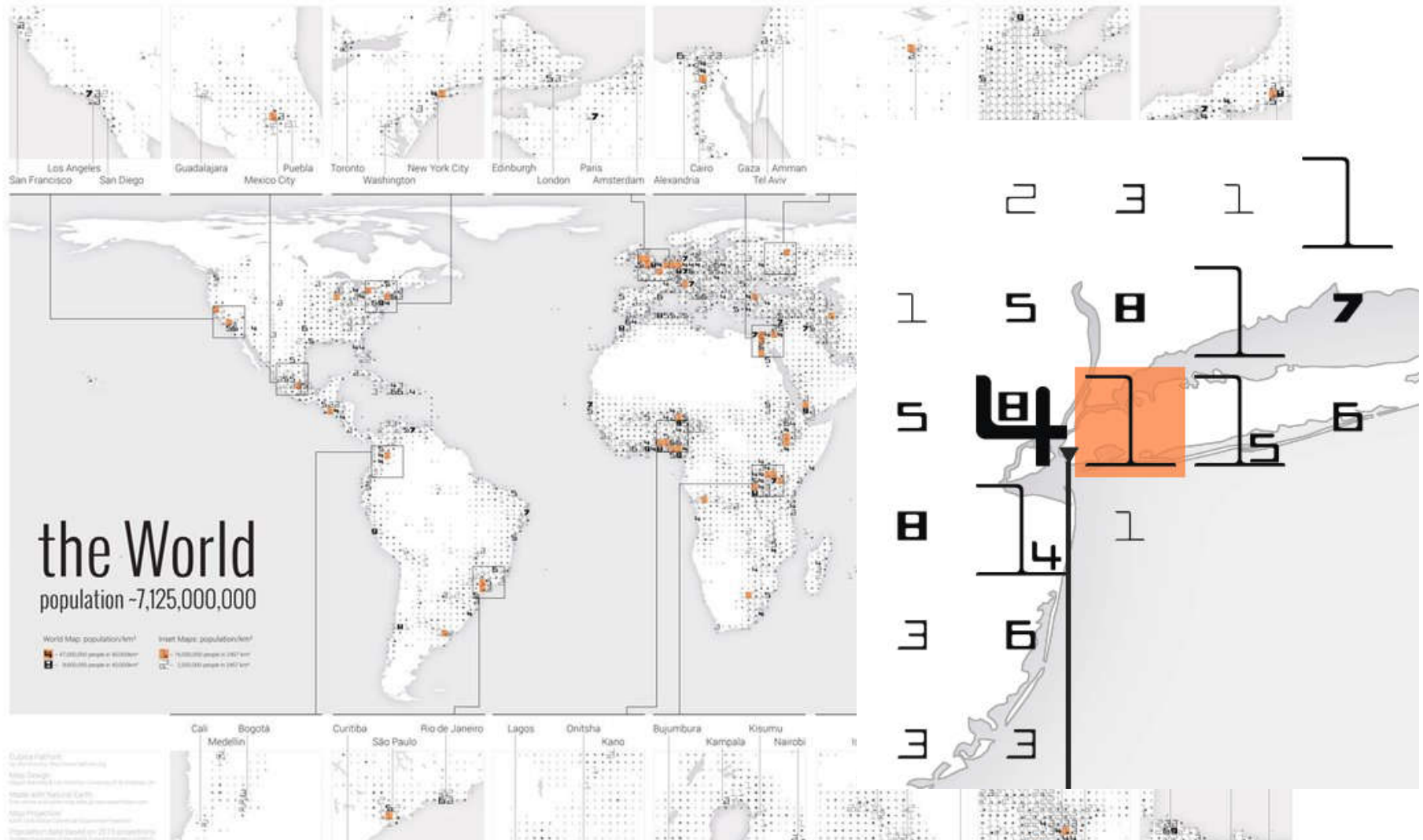


Scalar Field (KDE)

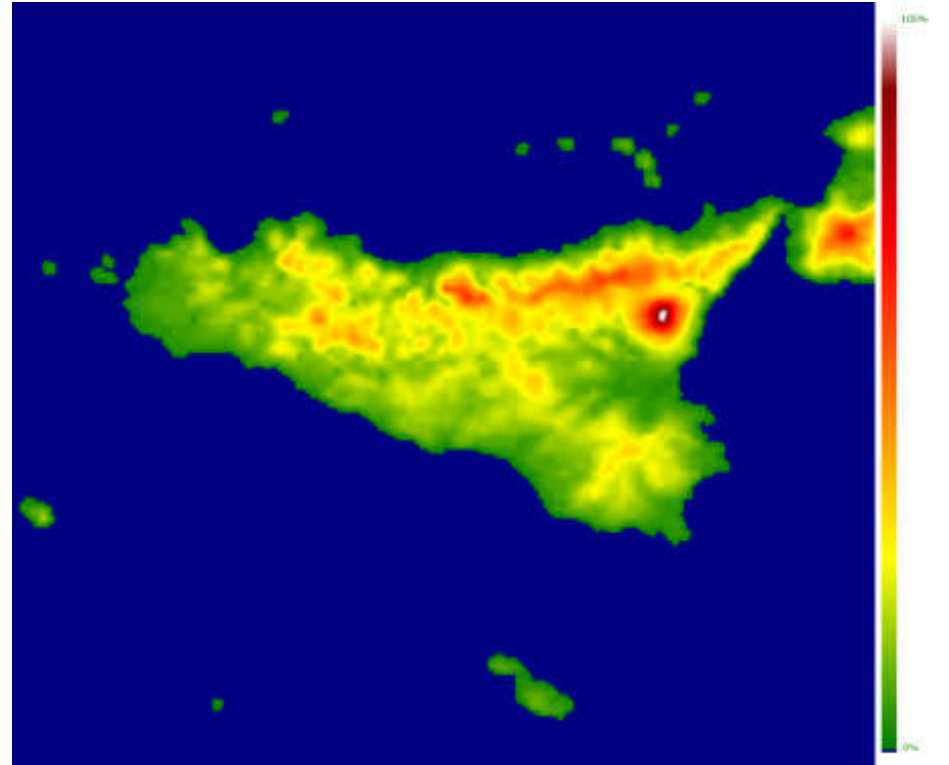
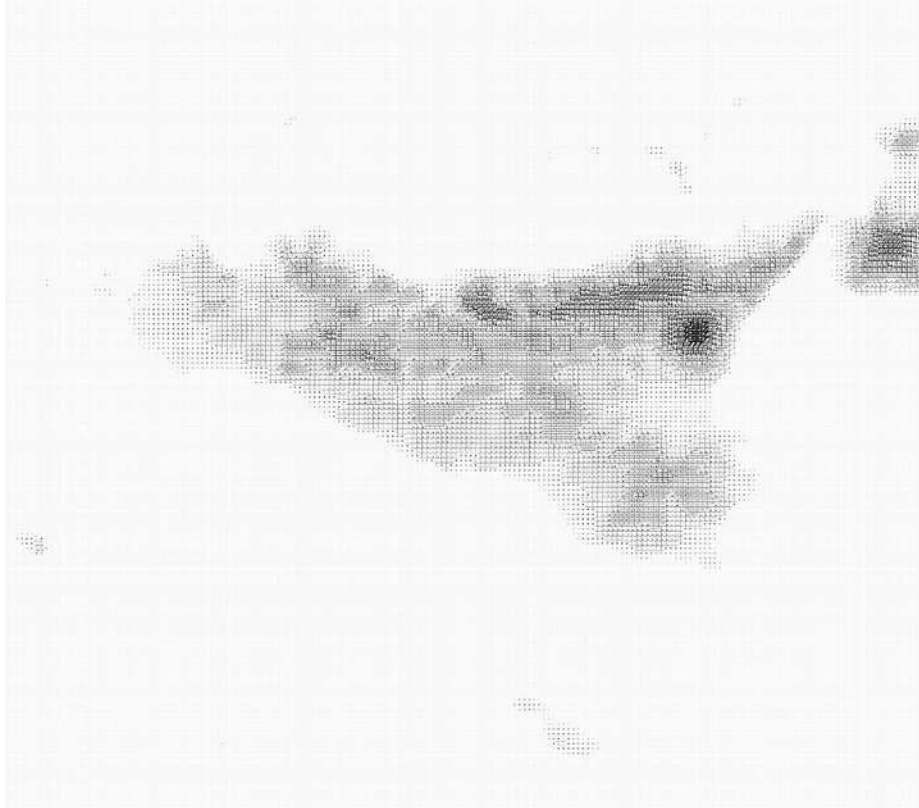
# Scalar Field (heightmap)

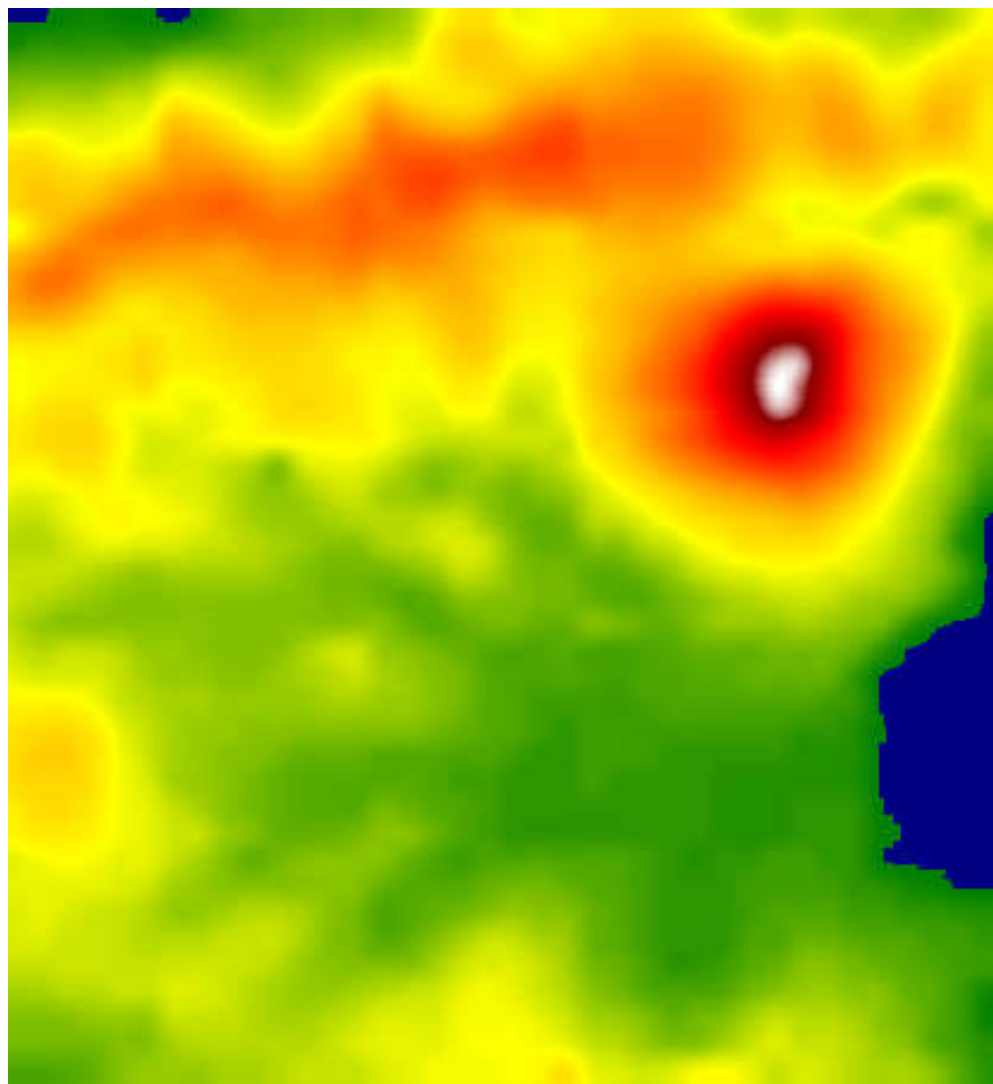
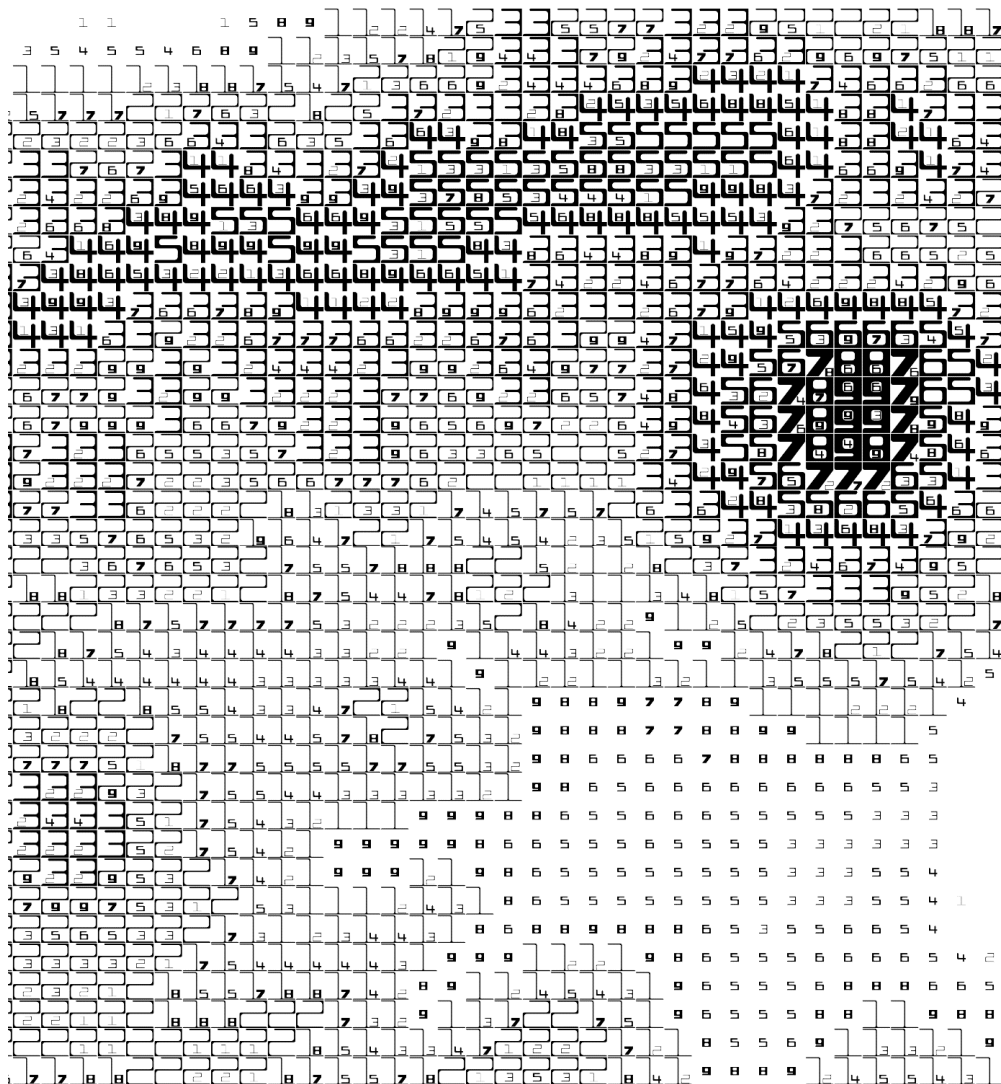


Sha Hwang. <http://postarchitectural.com/Crime-Reports>



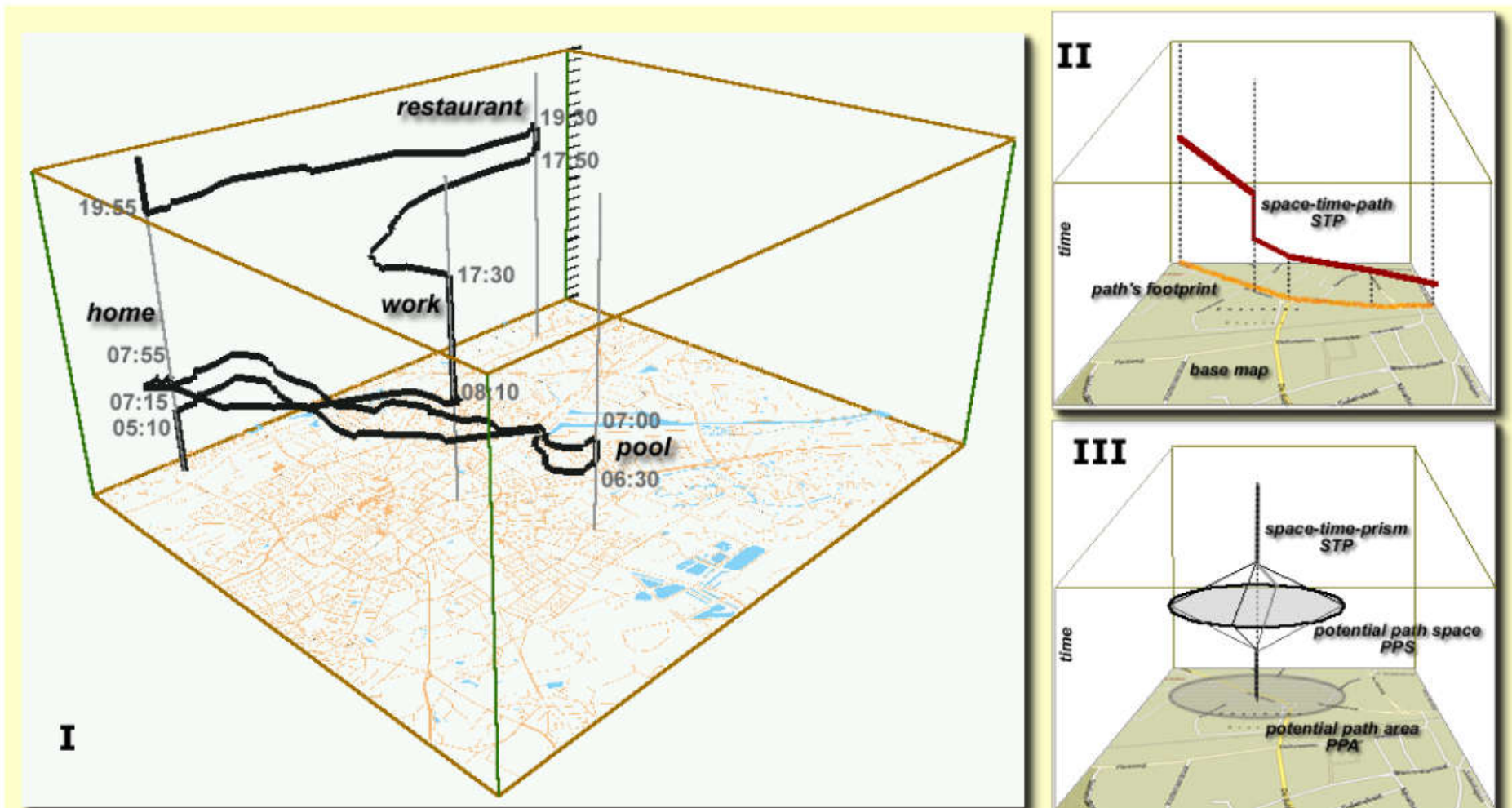
Nacenta, M., Hinrichs, U., & Carpendale, S. (2012, May). FatFonts: combining the symbolic and visual aspects of numbers. [ACM AVI]



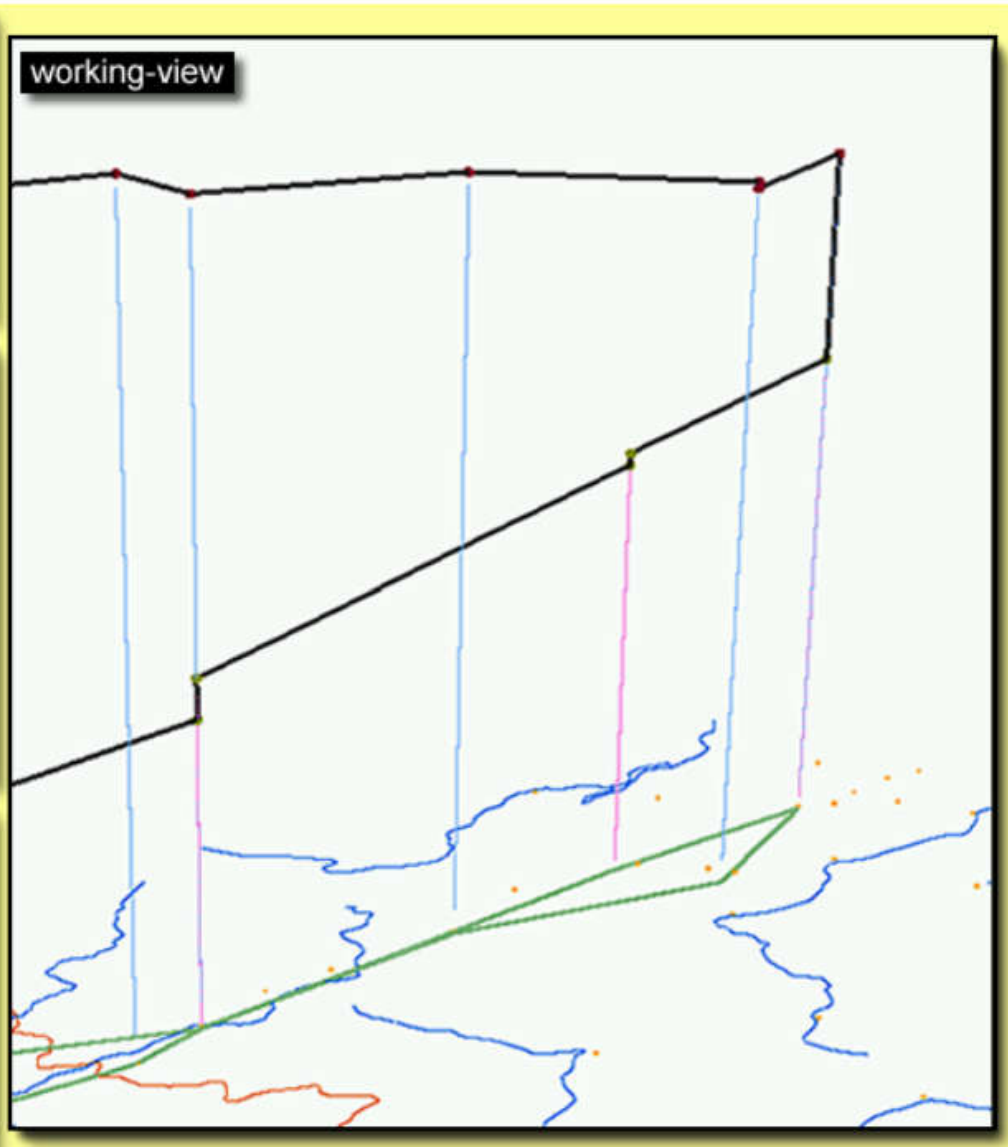
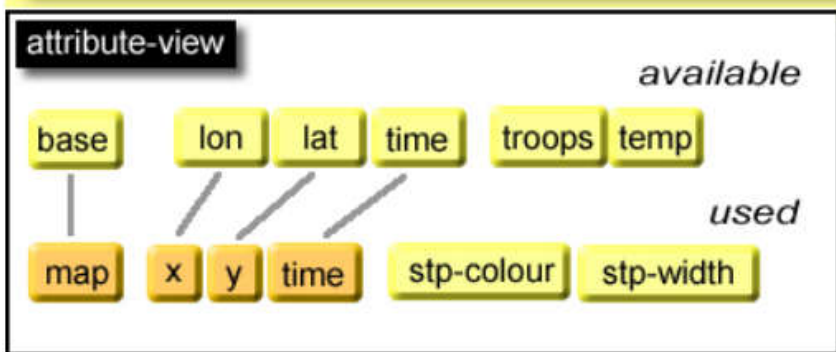
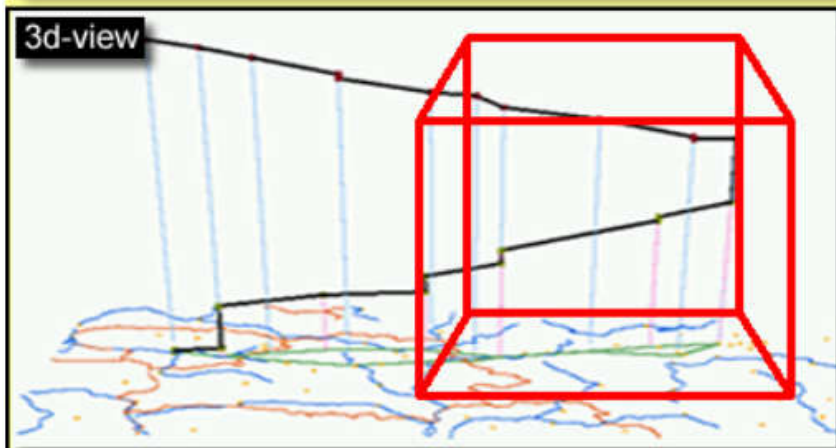
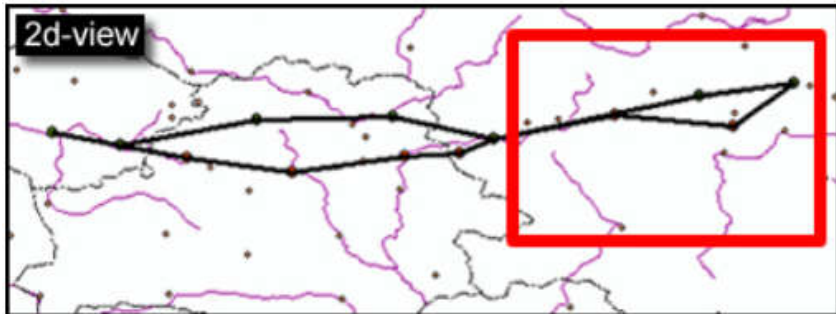


Space + Time





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



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

Dressée par M. Minard, Inspecteur Général des Lignes et Chaussées en retraite 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 ont été en Russie, le noir ceux qui en sont sortis. Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Légué, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée 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 Davoust qui avaient été détachés sur Minsk et Mabilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

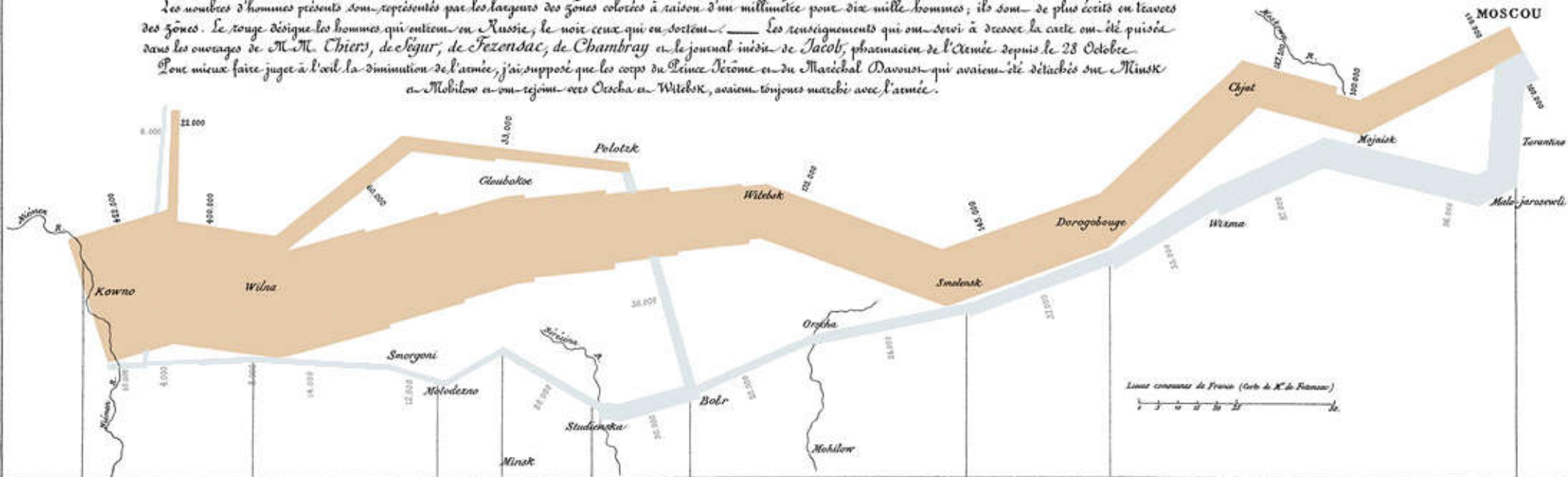
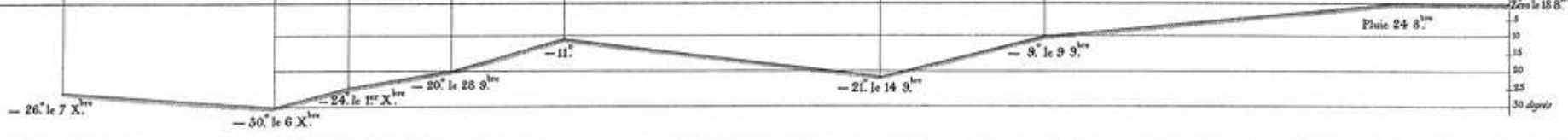


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.

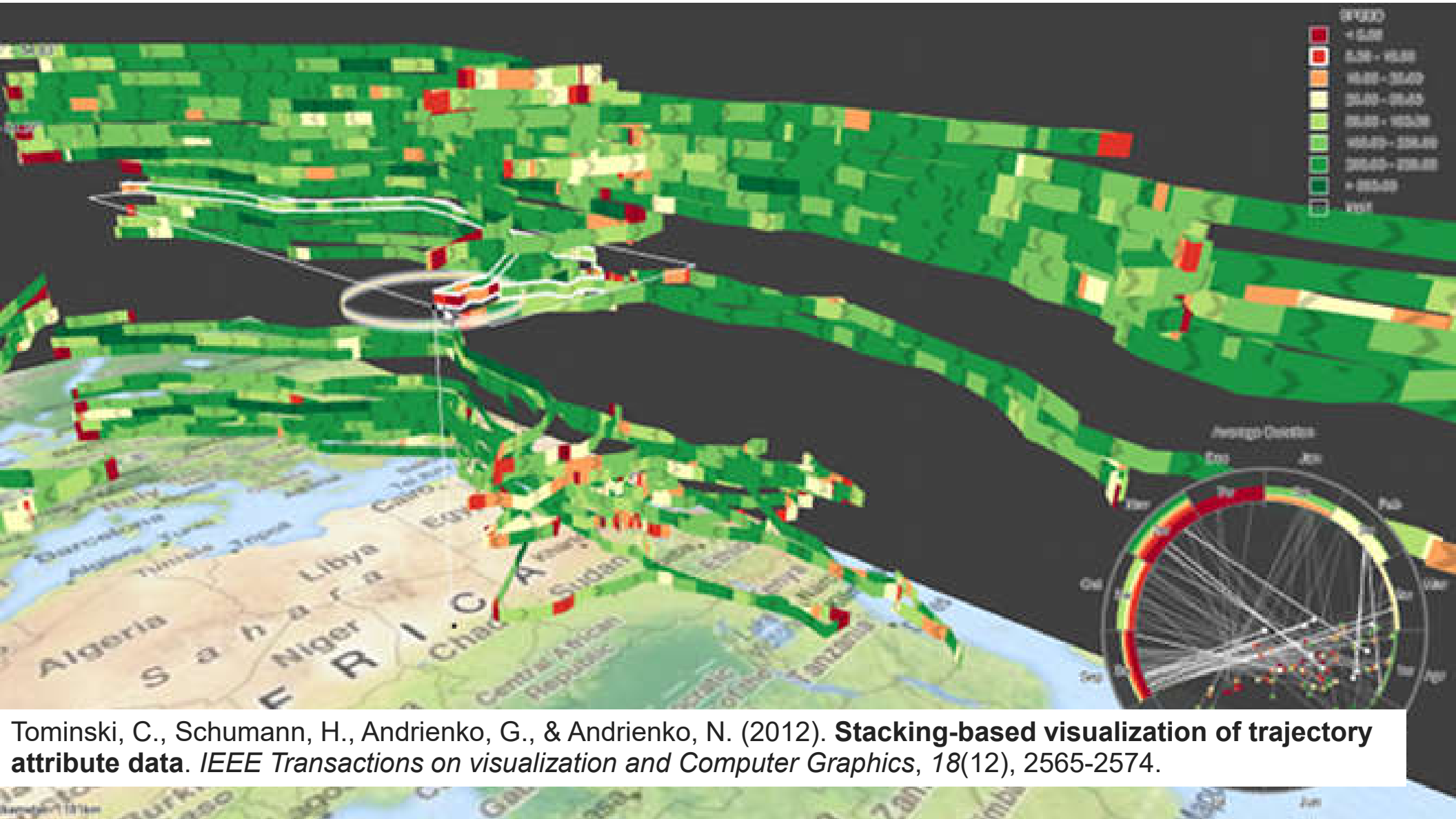


Les Cosaques passent au galop le Nilmen gelé.

Antiq. par Reyneir, à. Par. 5<sup>me</sup> Marie 3<sup>me</sup> 0<sup>me</sup> à Paris.

Imp. Lit. Reyneir et Desobry.

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

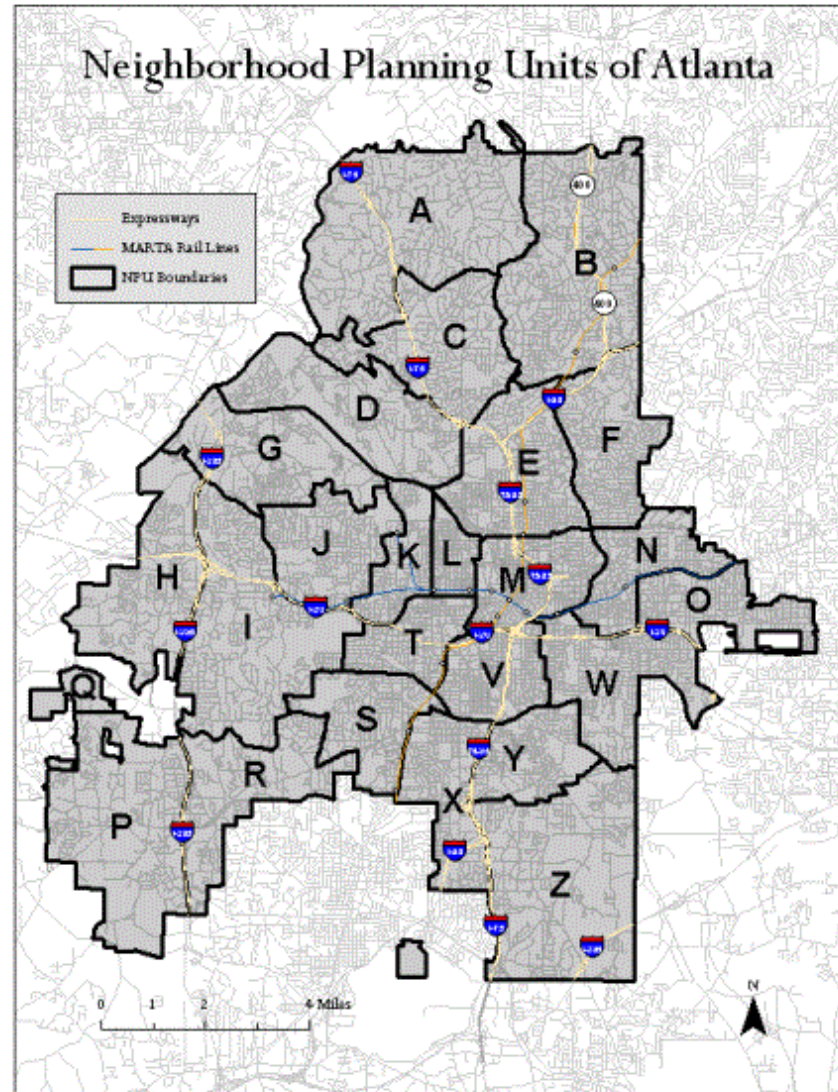
Pair Up

# 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

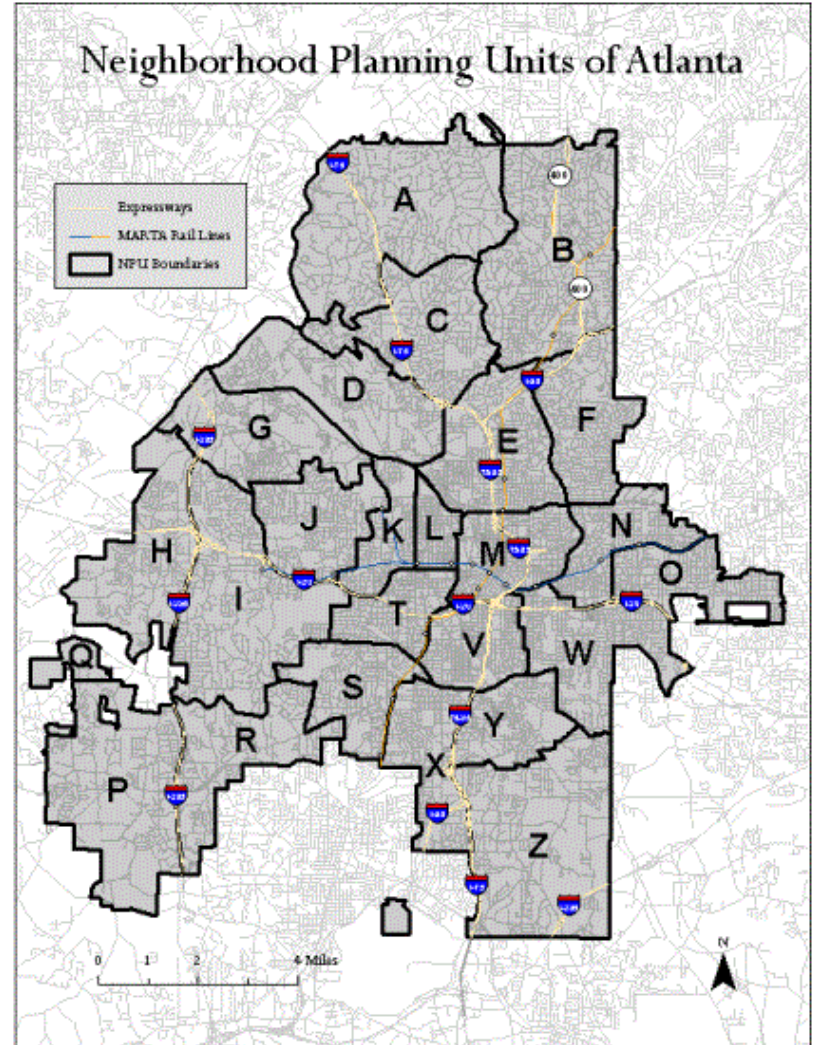
<u>NPU</u>	<u>Cats</u> (per capita)
J	5
K	7
L	2
M	12
T	20





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

<b>NPU</b>	<b>Cats (per capita)</b>
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

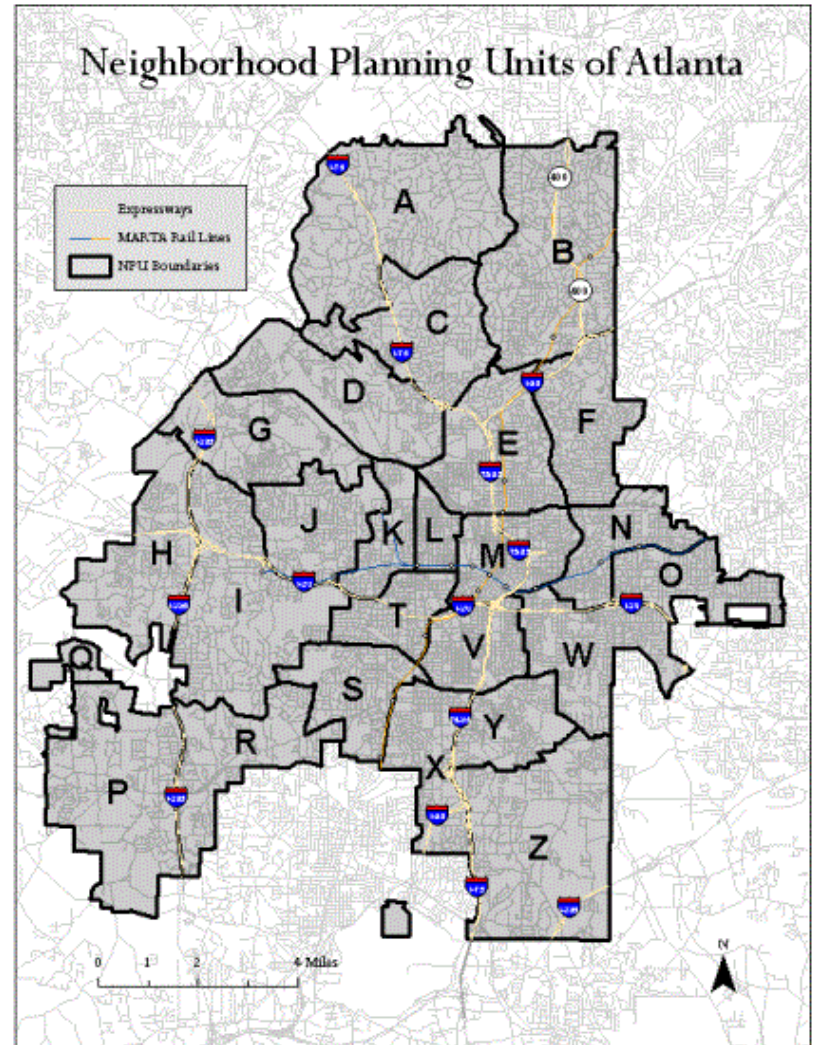
M

4

T

5

<b>NPU</b>	<b>Cats (per capita)</b>	<b>Node</b>	<b>Links</b>
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