Cartography

Spatial Computing – University of Minnesota

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Learning Objectives

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1. Understand the drastically **changed** (and changing) **professional context** of modern cartography.

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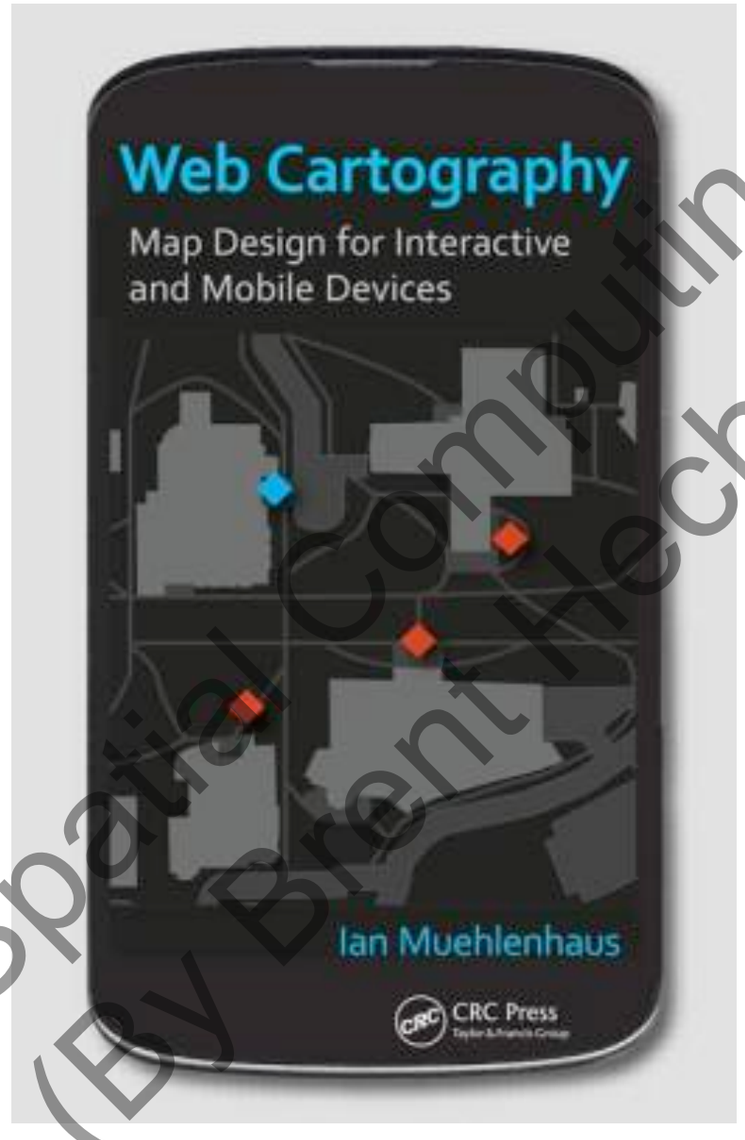

(Muehlenhaus 2013)

(Muehlenhaus 2013)

"All maps are a form of geo-communication. They are designed to **communicate something** about our **spatial environment** to a **map reader or user**... Geo-communication is at the core of defining what a map is because it exemplifies what a map does."

(Muehlenhaus 2013)

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"Excellent maps are designed with a communicative purpose [in mind]. A map that merely represents data is no more useful than an encyclopedia."

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World's oldest map: Spanish cave has landscape from 14,000 years ago

Archaeologists have discovered what they believe is man's earliest map, dating from almost 14,000 years ago.

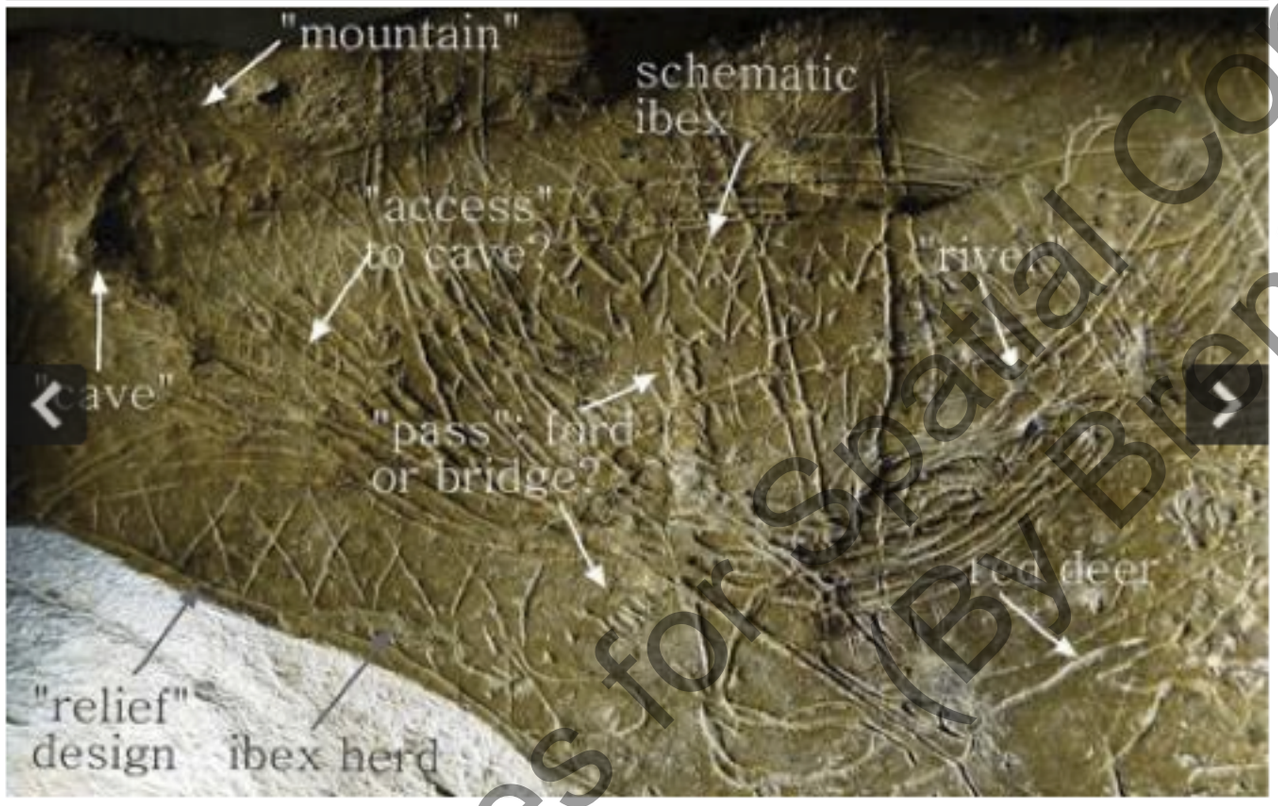

Image 1 of 2
Archaeologists have discovered what they believe is man's earliest map, dating from almost 14,000 years ago Photo: EPA

By Fiona Govan in Madrid
7:30AM BST 06 Aug 2009

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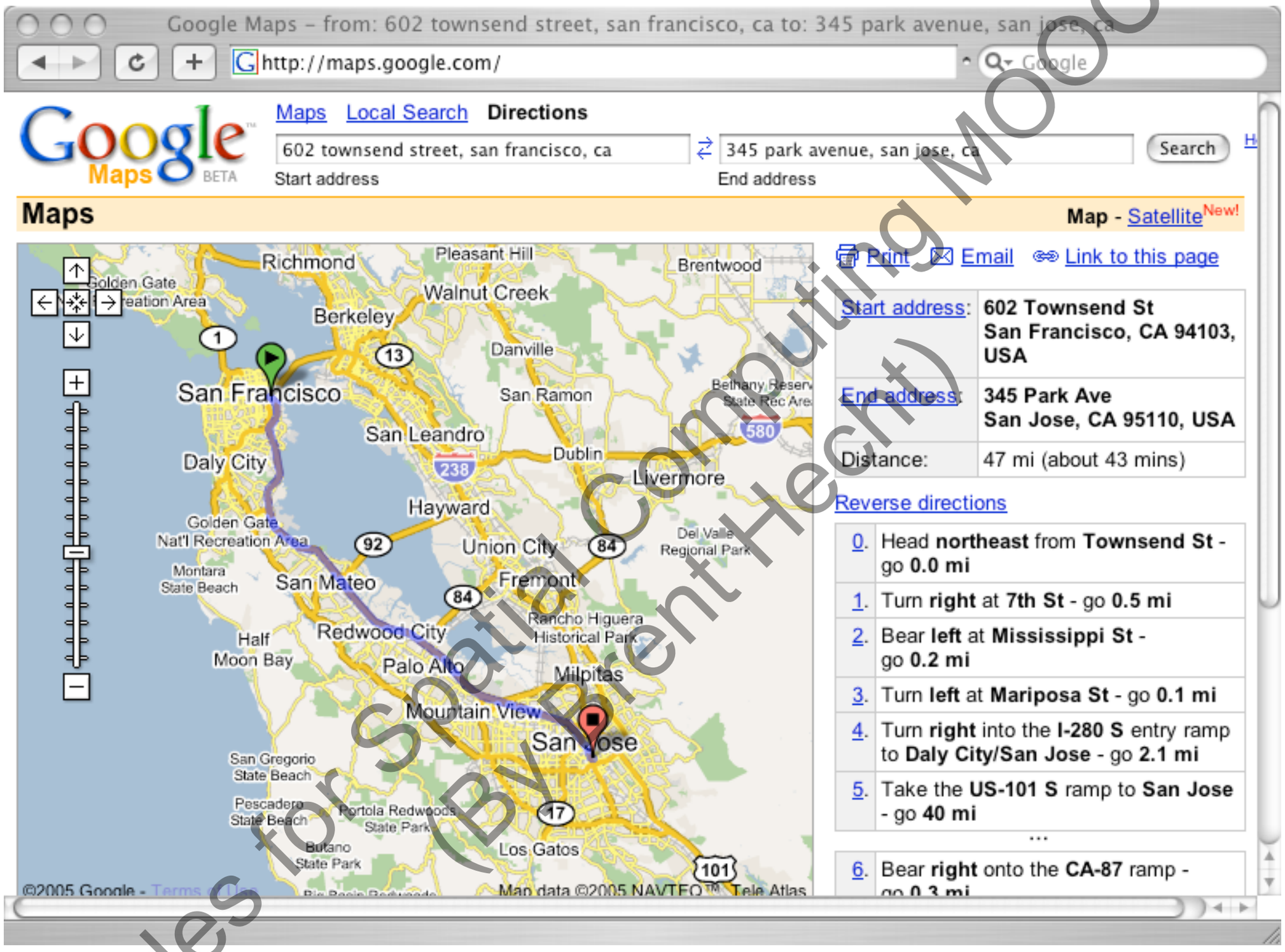

(Jackson 2005)

http://www.w3.org/2005/Talks/0513-webplatform/

Google Maps: There are very few cartographers involved

(Muehlenhaus 2013)

(Muehlenhaus 2013)

"Today, **a majority of online and mobile maps** are created by **computer scientists**, Web designers, or self-taught coders…In essence, it seems the craft of online mapmaking has developed **without too much input** from the discipline of **cartography** itself."

(Muehlenhaus 2013)

The dominance of computer science in cartography will persist unless "academic programs can **synthesize** the massive amount of **new knowledge** dealing with online and interactive maps and **contribute back to those actually designing maps**".

The 10 Most Popular Apps in the U.S.

Average monthly users (18+) of the most popular smartphone apps in the United States in 2013

* includes iTunes, App Store and Game Center

Source: comScore

Mashable statista

http://www.statista.com/chart/2082/top-smartphone-apps-2013/

Google Maps

https://www.google.com/maps/@40.4523885,-82.368469,2z

Google

Terrain, Directions

+Brent

2

Share

Greenland

Iceland

Finland

Sweden

Norway

Russia

United Kingdom

Canada

Poland

Germany

Ukraine

Kazakhstan

France

Spain

Italy

Turkey

China

Japan

South Korea

North Pacific Ocean

United States

North Atlantic Ocean

Iraq

Iran

Afghanistan

Pakistan

India

Algeria

Libya

Egypt

Saudi Arabia

Mexico

Mali

Niger

Chad

Sudan

Nigeria

Ethiopia

Venezuela

Colombia

Kenya

DR Congo

Tanzania

Brazil

Peru

Angola

Bolivia

Namibia

Botswana

Madagascar

Indonesia

Papua New Guinea

Australia

South Pacific Ocean

Chile

South Atlantic Ocean

South Africa

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Argentina

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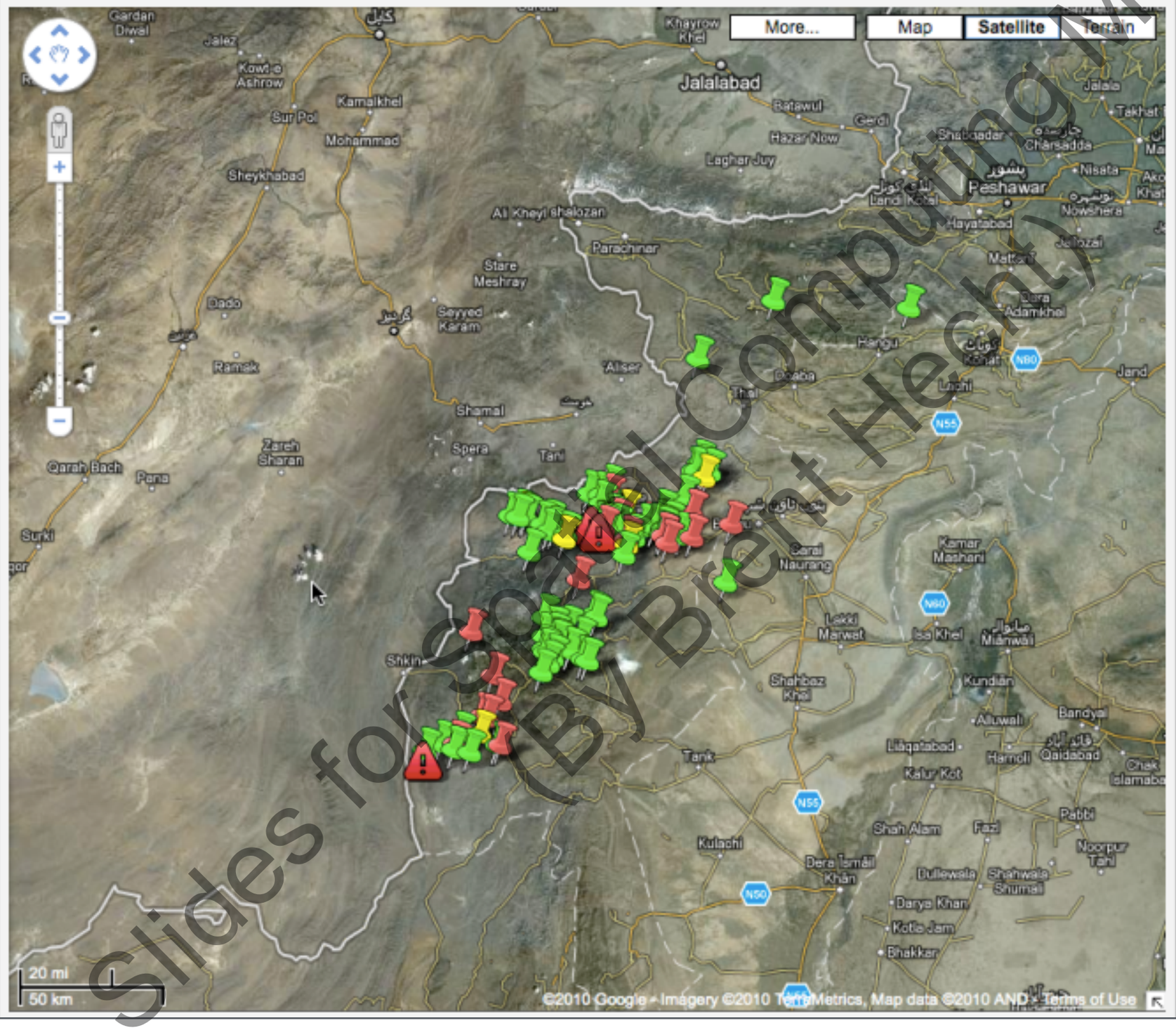
mashup of US drone attacks in Pakistan:



http://cartastrophe.wordpress.com/2010/03/22/a-war-without-humans/

time machine
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I Love Typography

categories
Animated (1)
Author Criticism (5)
Choropleth (9)

(Muehlenhaus 2013)

"The forthcoming pages demonstrate just how **different Web cartography is from paper mapping**, but they will also impress on you the fact that, for all of the differences, **many of the core tenets of cartography remain intact**".

Two groups of people are essential to the future of online/mobile maps:

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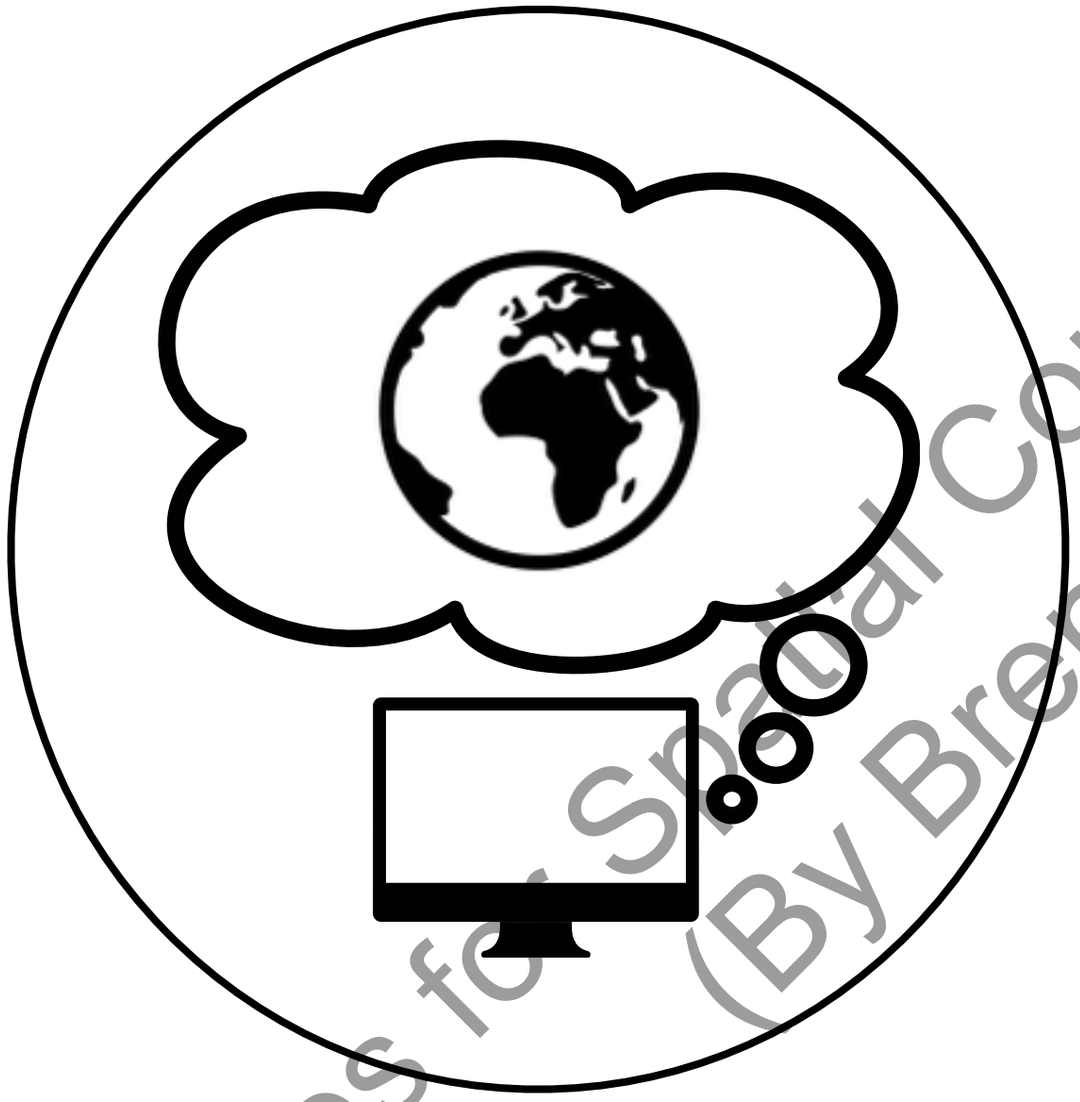

Computing-oriented folks who lack a formal cartography background

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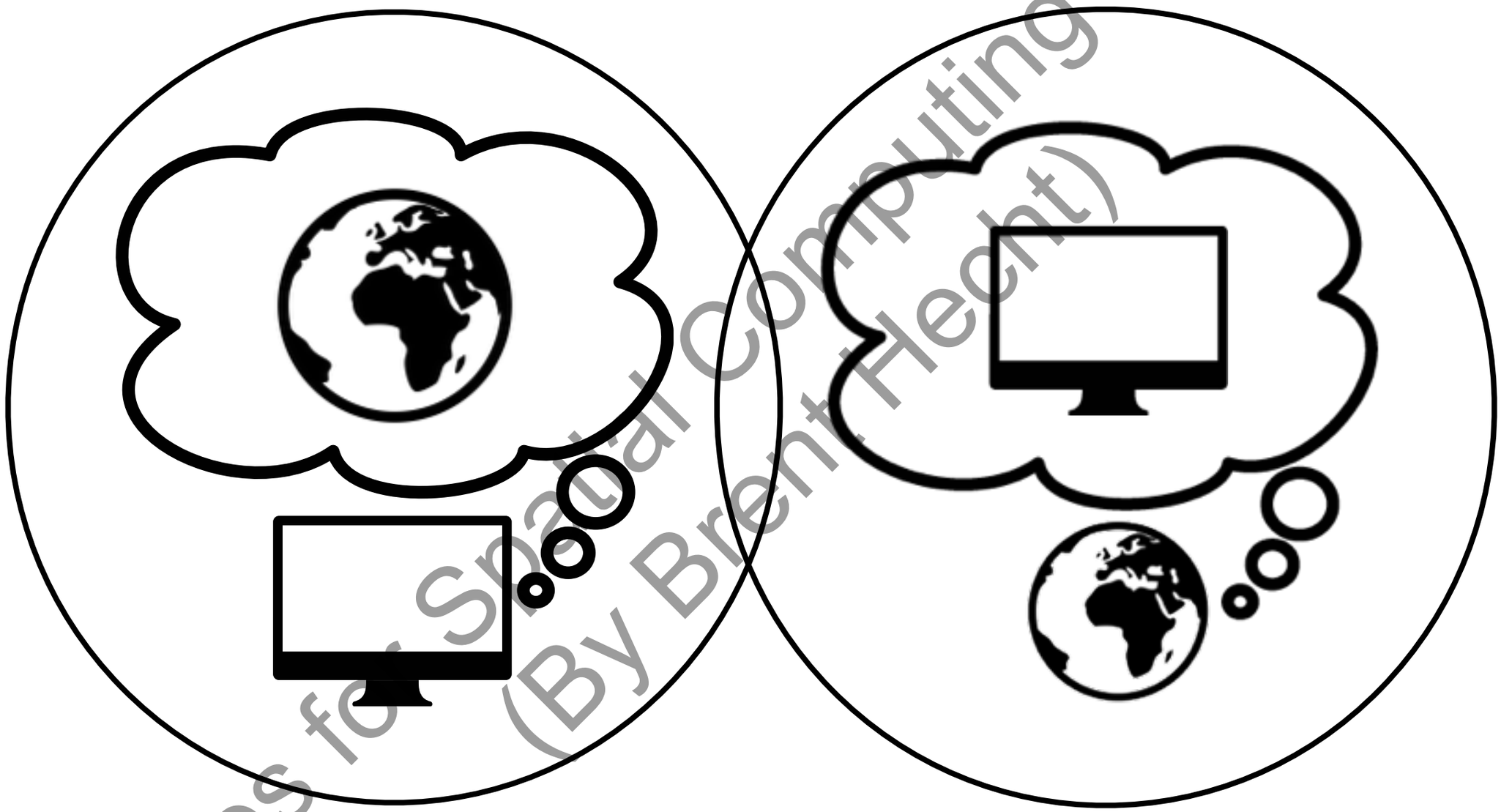

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Carto/Geo-oriented folks who lack a formal computing background

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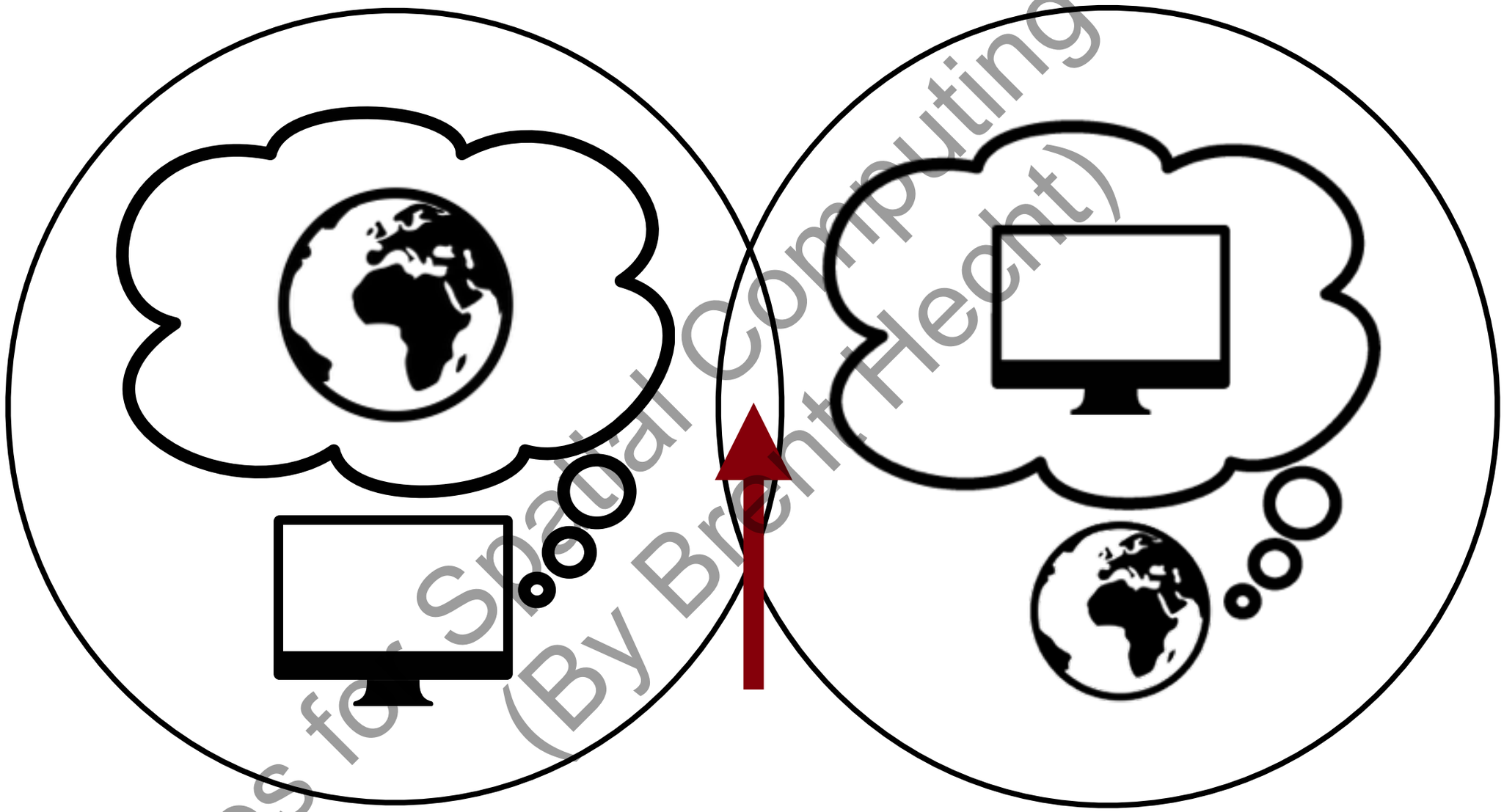

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Carto/Geo-oriented folks who lack a formal computing background

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Attributions

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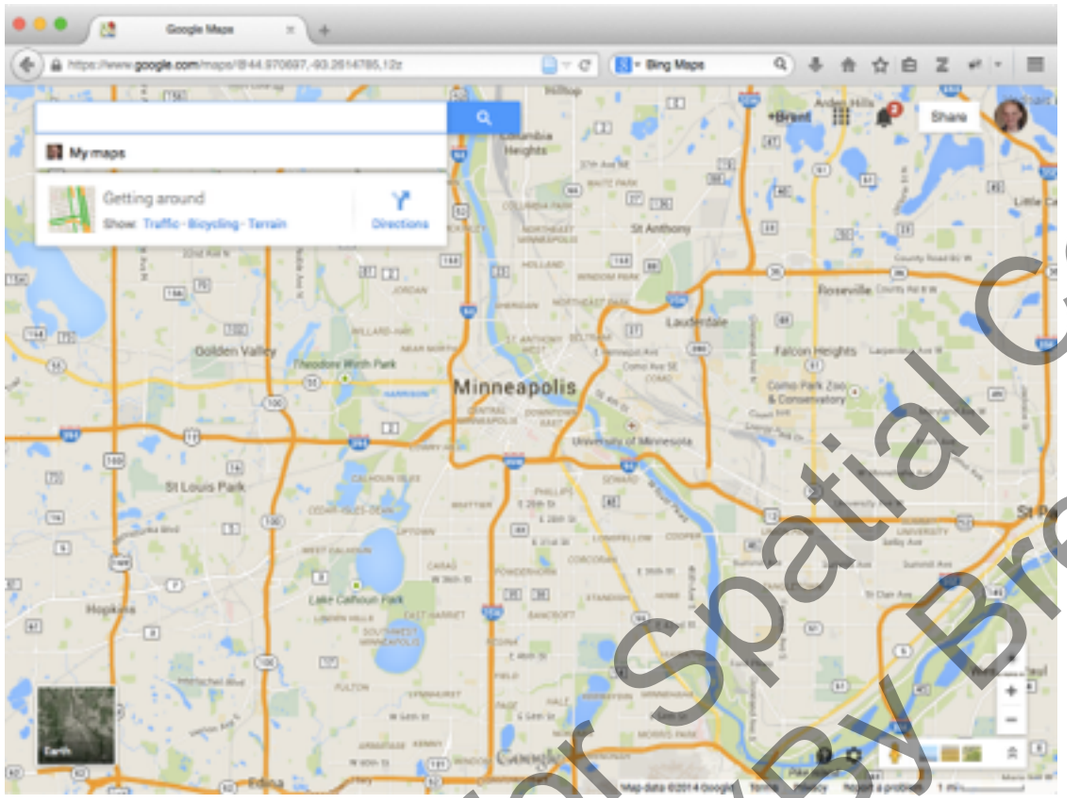
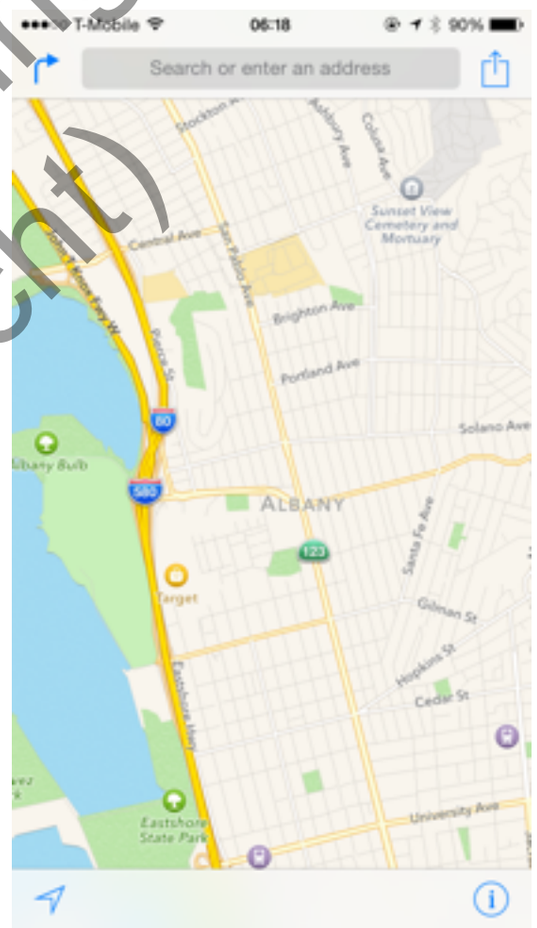
The two types of most commonly-encountered maps for many people:



Online maps

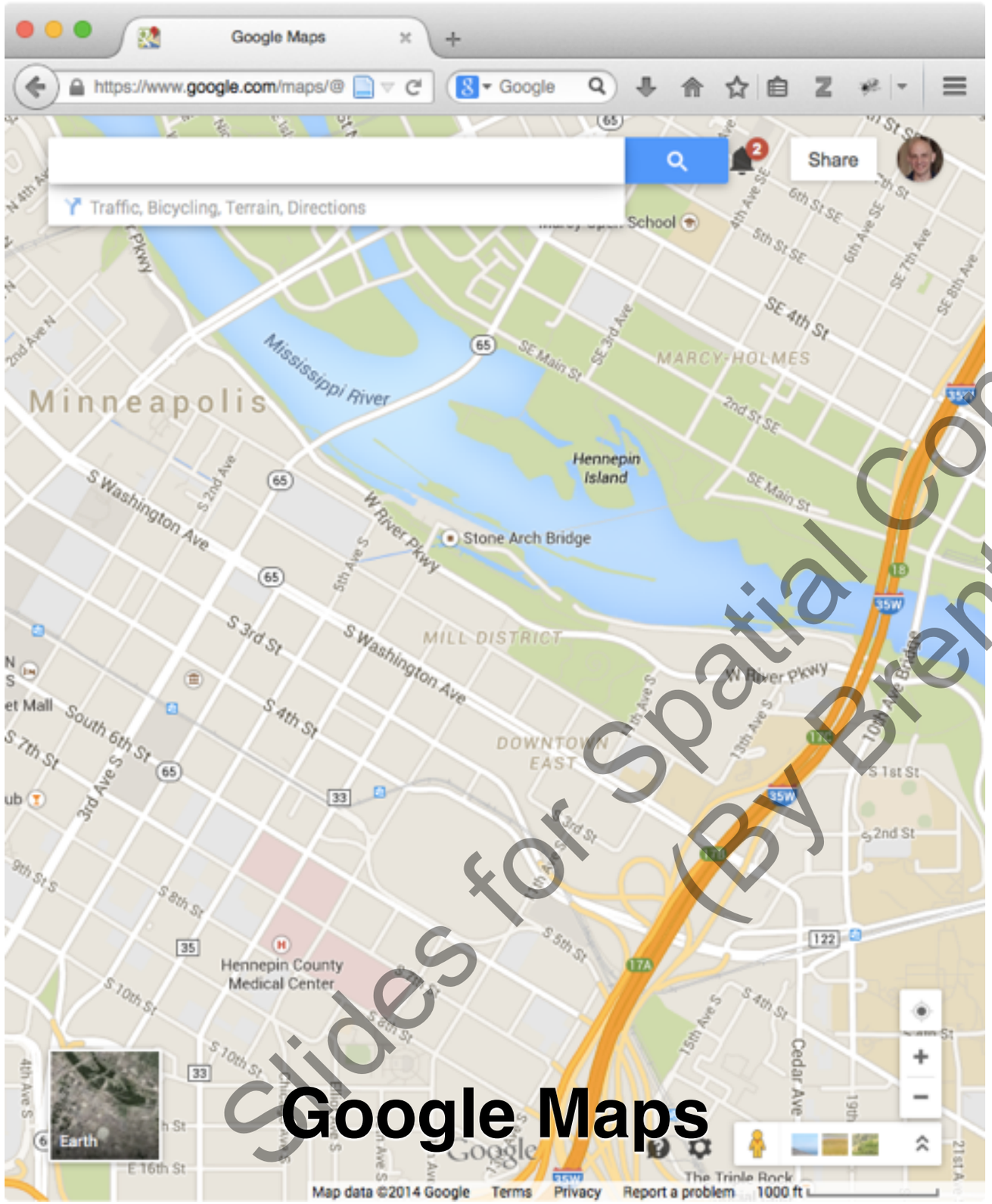
(a.k.a. map websites)

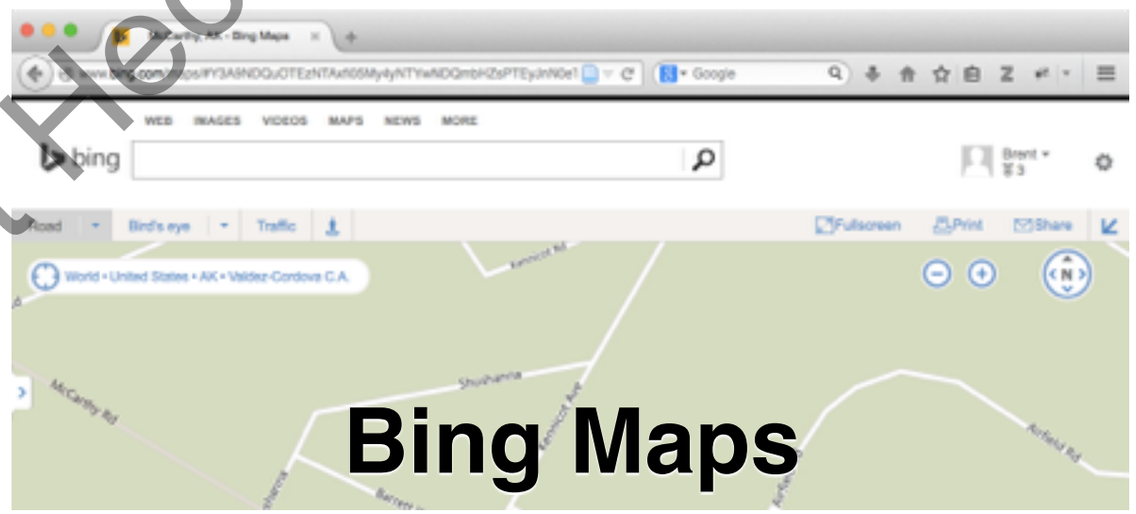


Mobile Maps

(a.k.a. map smartphone apps)

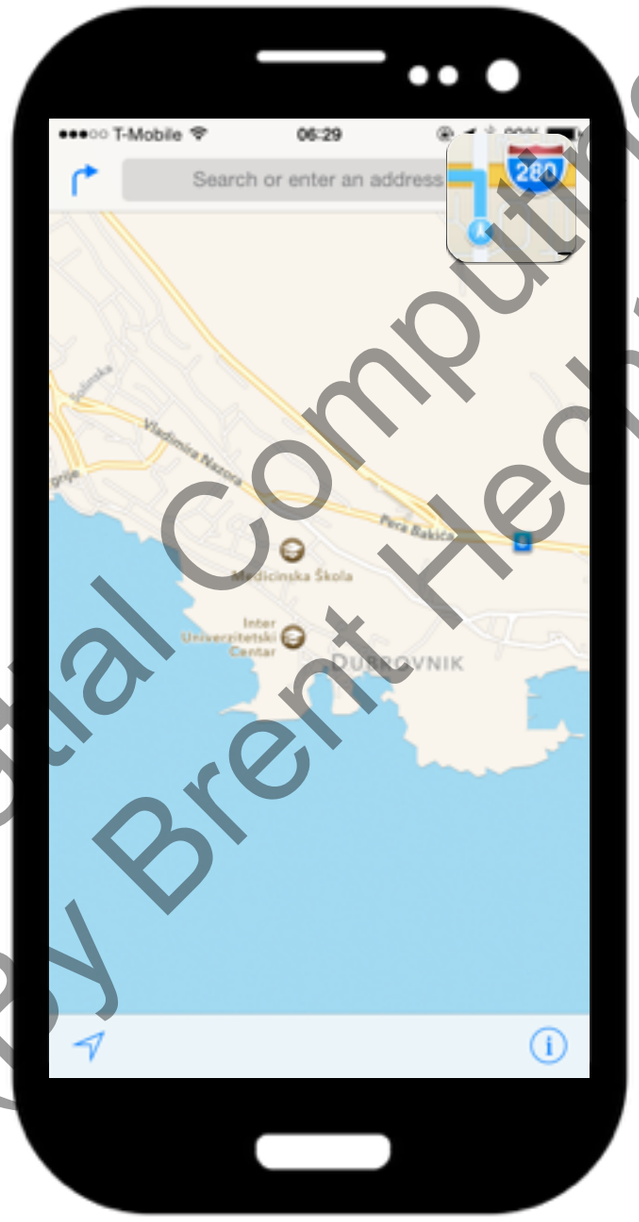
Well-known “online maps” / map websites:





Well-known mobile map apps:

Google Maps app



Apple Maps app

Waze

Nokia HERE Maps

The 10 Most Popular Apps in the U.S.

Average monthly users (18+) of the most popular smartphone apps in the United States in 2013

* includes iTunes, App Store and Game Center

Source: comScore

Mashable statista

http://www.statista.com/chart/2082/top-smartphone-apps-2013/

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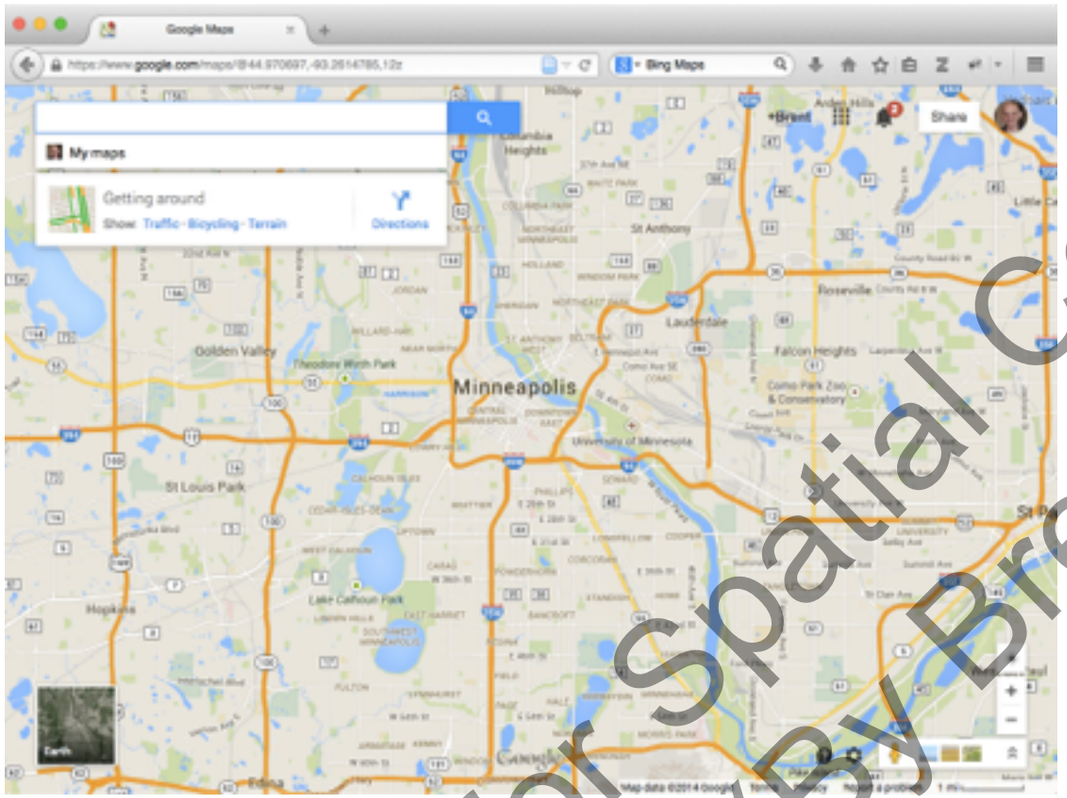

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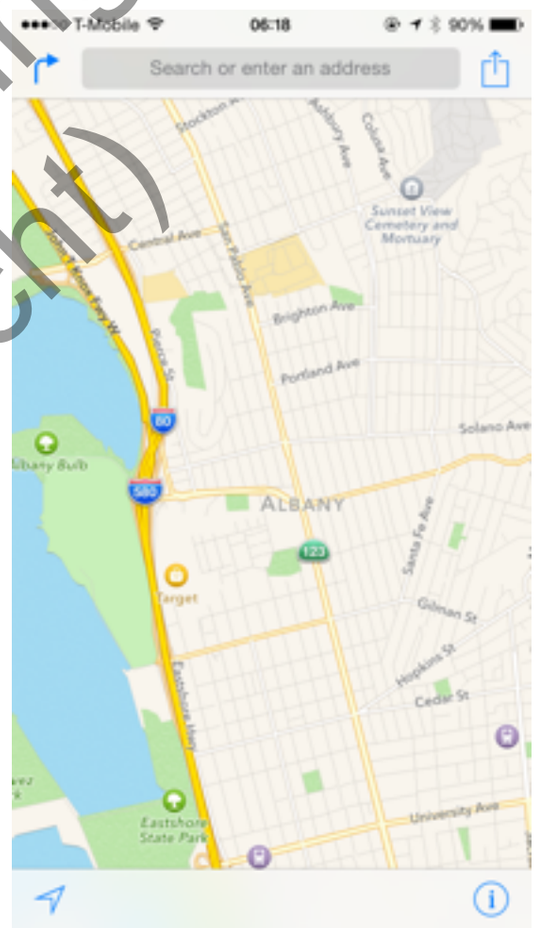
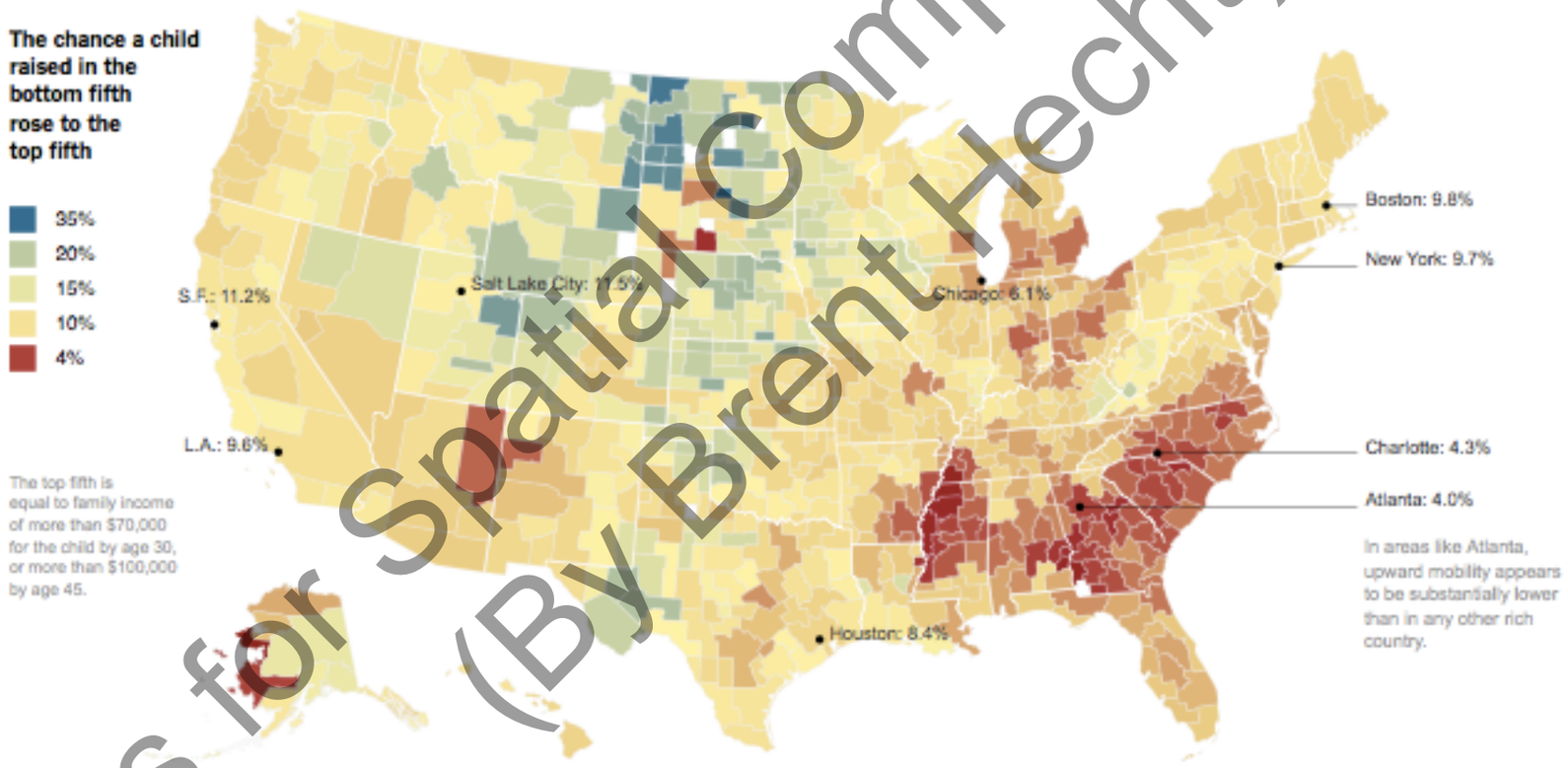


Mobile Maps

(a.k.a. map smartphone apps)

In Climbing Income Ladder, Location Matters

A study finds the odds of rising to another income level are notably low in certain cities, like Atlanta and Charlotte, and much higher in New York and Boston.



By DAVID LEONHARDT PUBLISHED: JULY 22, 2013 536 COMMENTS

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ATLANTA – Stacey Calvin spends almost as much time commuting to her job — on a bus, two trains and another bus — as she does working part-time at a day

Foreign fighters flow to Syria...

-fighters-flow-to-syria/2014/10/11/3d2549fa-5195-11e4-8c24-487e92bc997b_graphic.h

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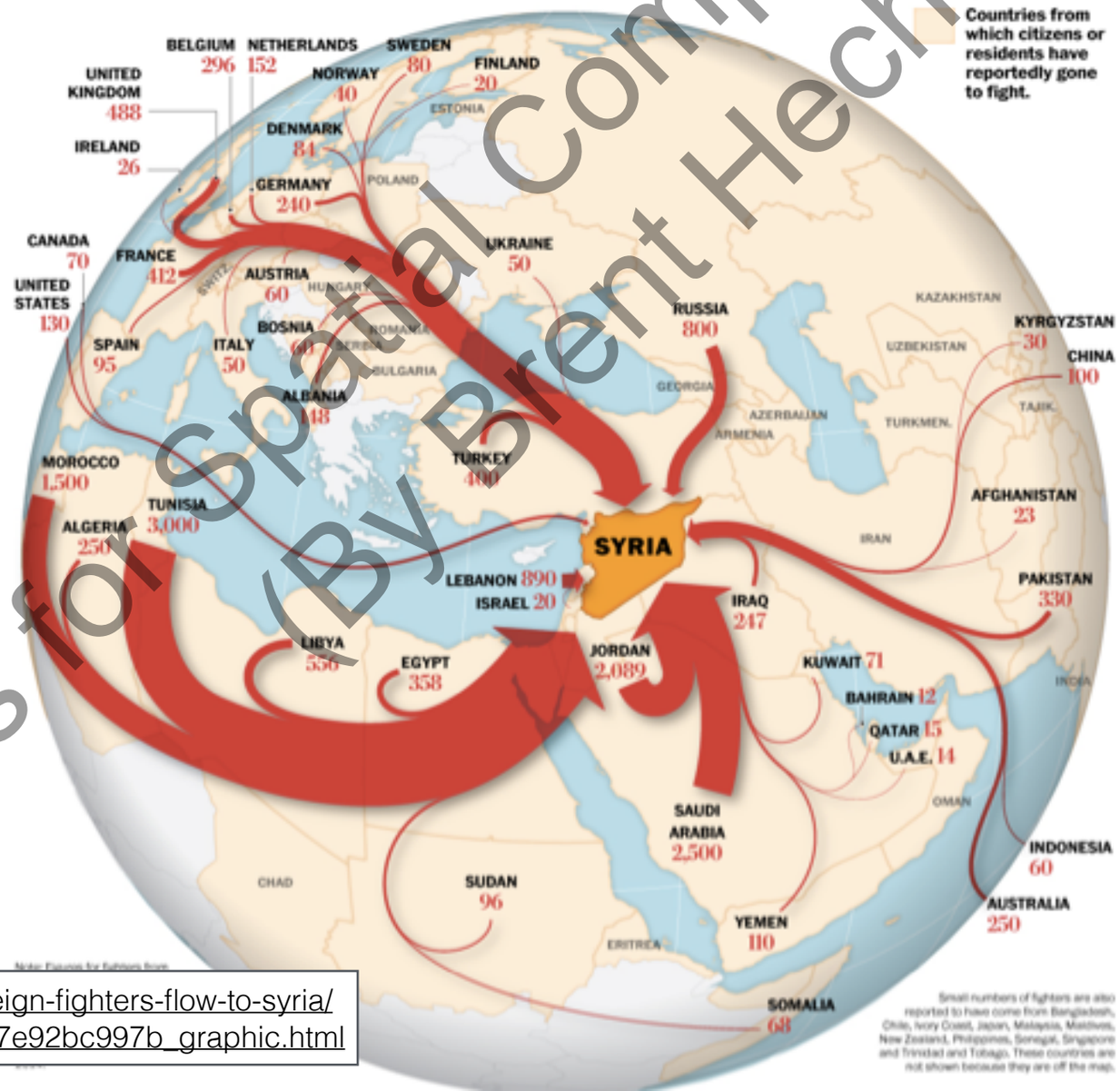
Ad

Foreign fighters flow to Syria

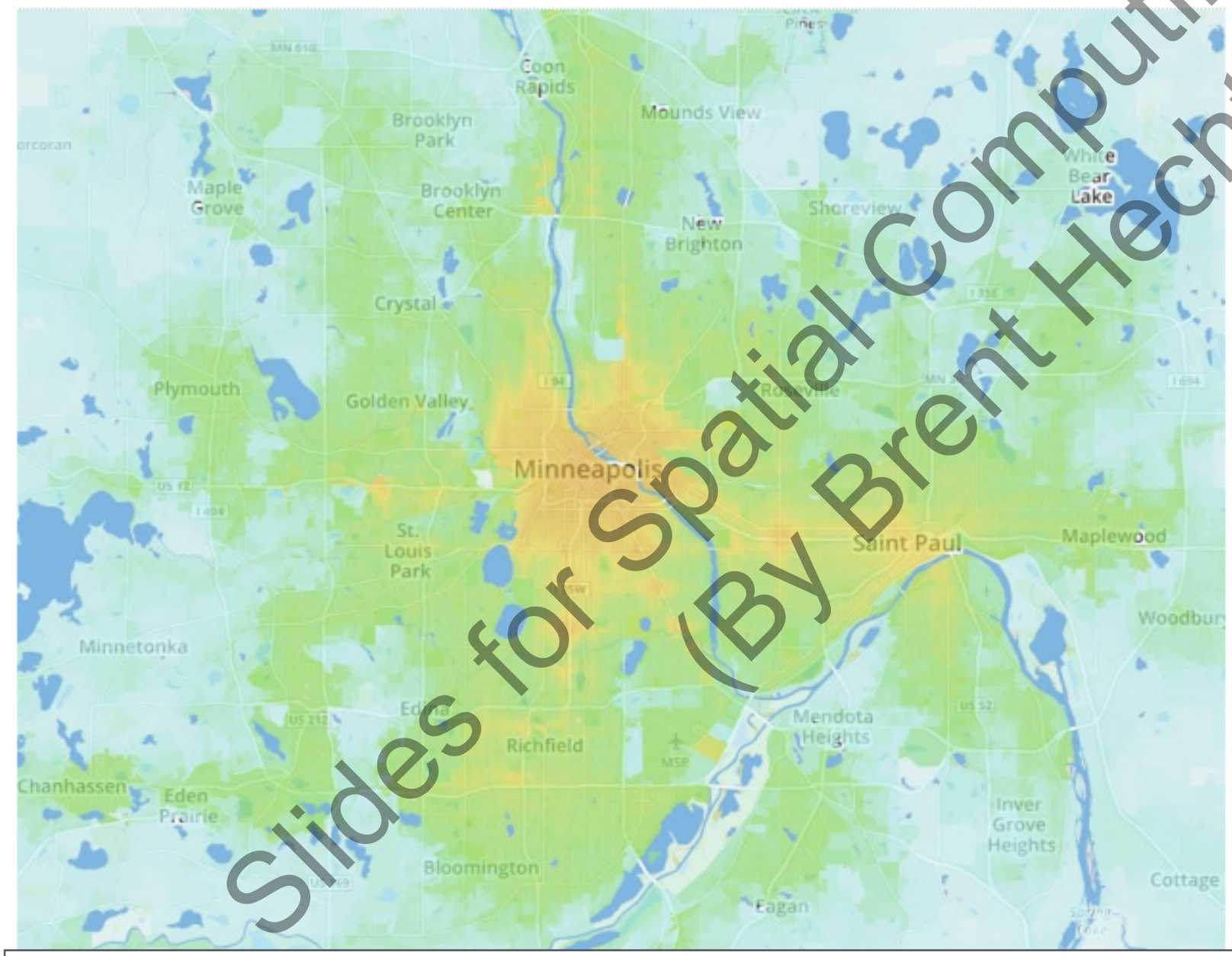
An estimated 15,000 militants from at least 80 nations are believed to have entered Syria to help overthrow the regime of President Bashar al-Assad according the CIA and studies by ISCR and The Soufan Group. Many of these fighters are believed to have joined units that are now part of the Islamic State. Western officials are concerned about what these individuals may do upon returning to their native countries.



http://www.washingtonpost.com/world/foreign-fighters-flow-to-syria/2014/10/11/3d2549fa-5195-11e4-8c24-487e92bc997b_graphic.html

MAP: The best places to be a Twin Cities transit commuter

Posted by: Eric Roper | Updated: October 7, 2014 - 5:43 PM



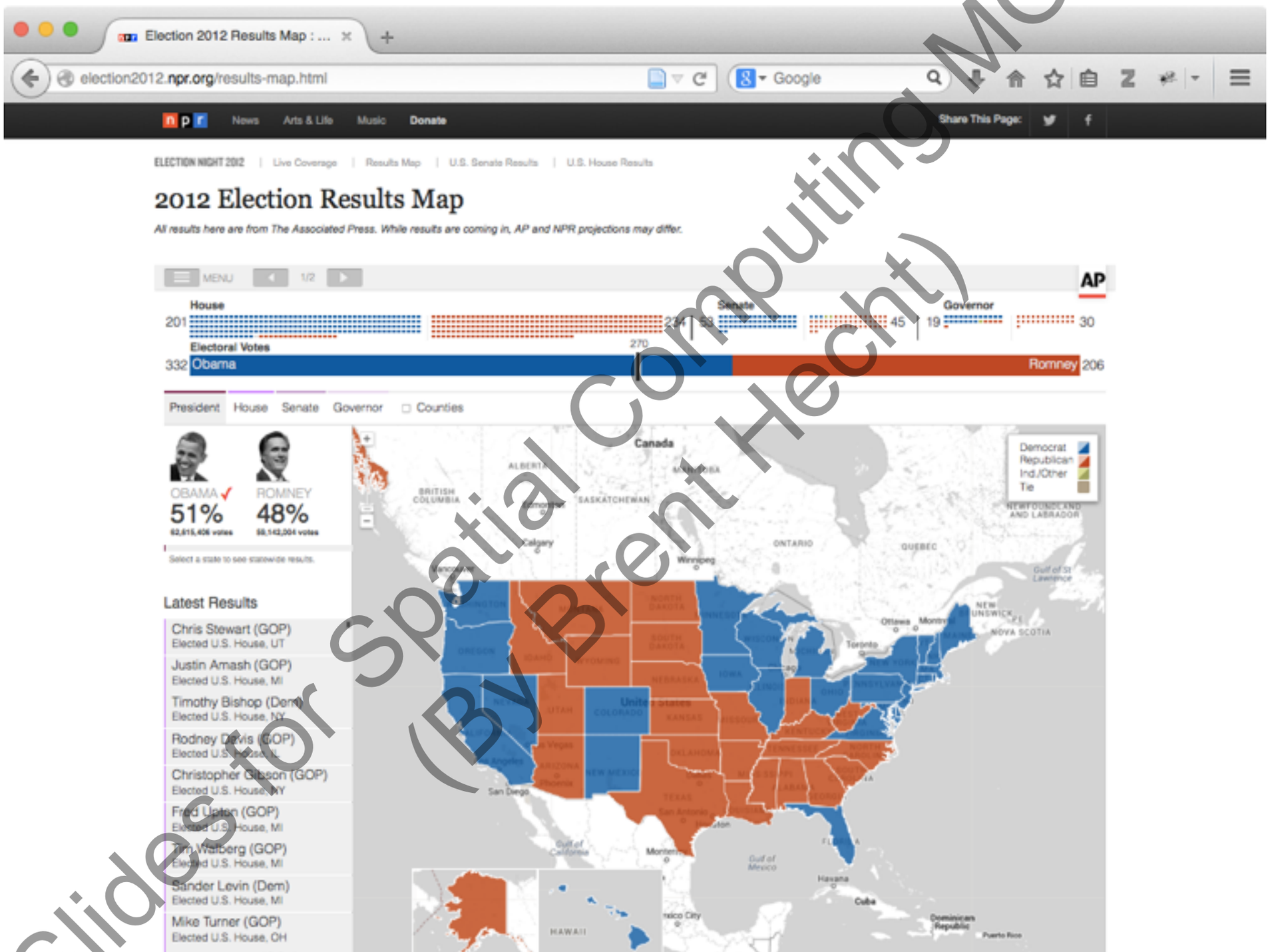
http://www.statista.com/chart/2082/top-smartphone-apps-2013/

Click here to see the full map, with a legend.

recent posts

- 2 Minneapolis officers praised for saving man stabbed downtown
- Man with dog shoots up 19 Bar, wounding two before fleeing
- Minneapolis seeks high-rise for Nicollet Hotel

Election maps:



http://election2012.npr.org/results-map.html

Bundestagswahl 2013 in Ber…

berlinwahlkarte2013.morgenpost.de

Google

Berliner Morgenpost Bundestagswahl 2013 in Berlin **Alle Stimmen der 1709 Wahllokale**

Bitte Adresse eingeben (z.B. Friedrichstr. 205)

So hat Berlin gewählt (Zweitstimmen)

Klicken Sie auf die Parteien für die **Hochburgen** (Top 10).

1. CDU 28,5%
2. SPD 24,6%
3. Linke 18,5%
4. Grüne 12,3%
5. AfD 4,9%
6. Piraten 3,6%
7. FDP 3,6%

Sonstige 4,0%

Direktkandidaten (Erststimmen)

» Diese Berliner sind im Bundestag

Julius Tröger, Andres Pätzold, Moritz Klack, Quelle: Landeswahlleiterin Berlin, 23.09.2013

Map data ©2014 GeoBasis-DE/BKG (©2009), Google | Terms of Use

WECHSEL-WÄHLER

KNAPPES ERGEBNIS

KLEINPARTEIEN
Hier kommen die Kleinen groß raus

HARTZ-IV
Kieze mit den Langzeitarbeit

http://berlinwahlkarte2013.morgenpost.de/

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www.ndtv.com/elections/general-election-results-2014

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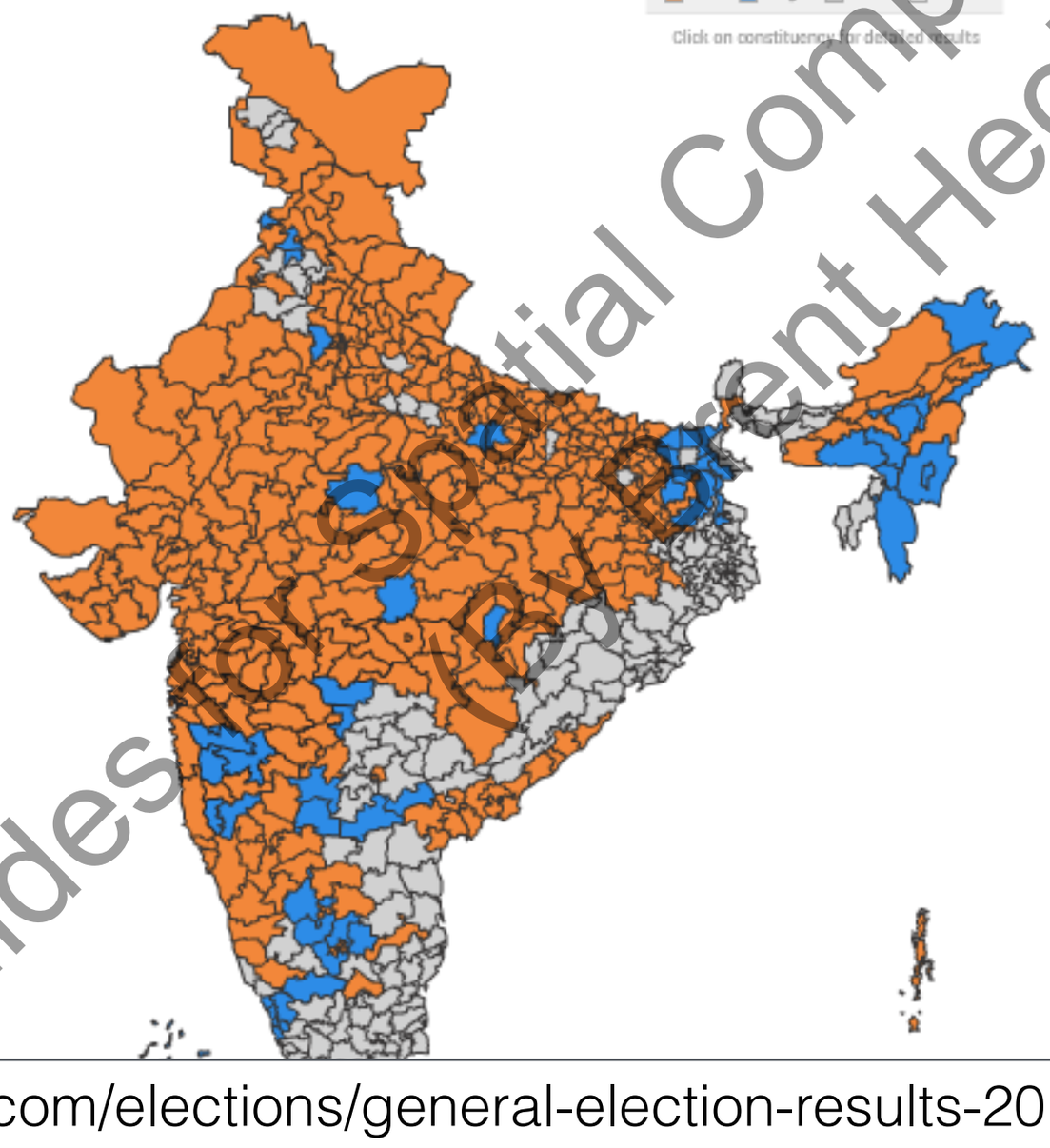
India

BJP+ | Congr | Others | Awaited

Click on constituency for detailed results



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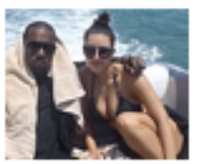

Kim and Kanye's Honeymoon Has Us Very Jealous

Glam

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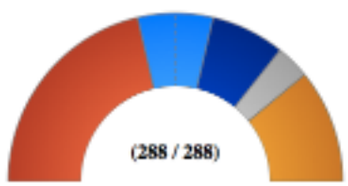
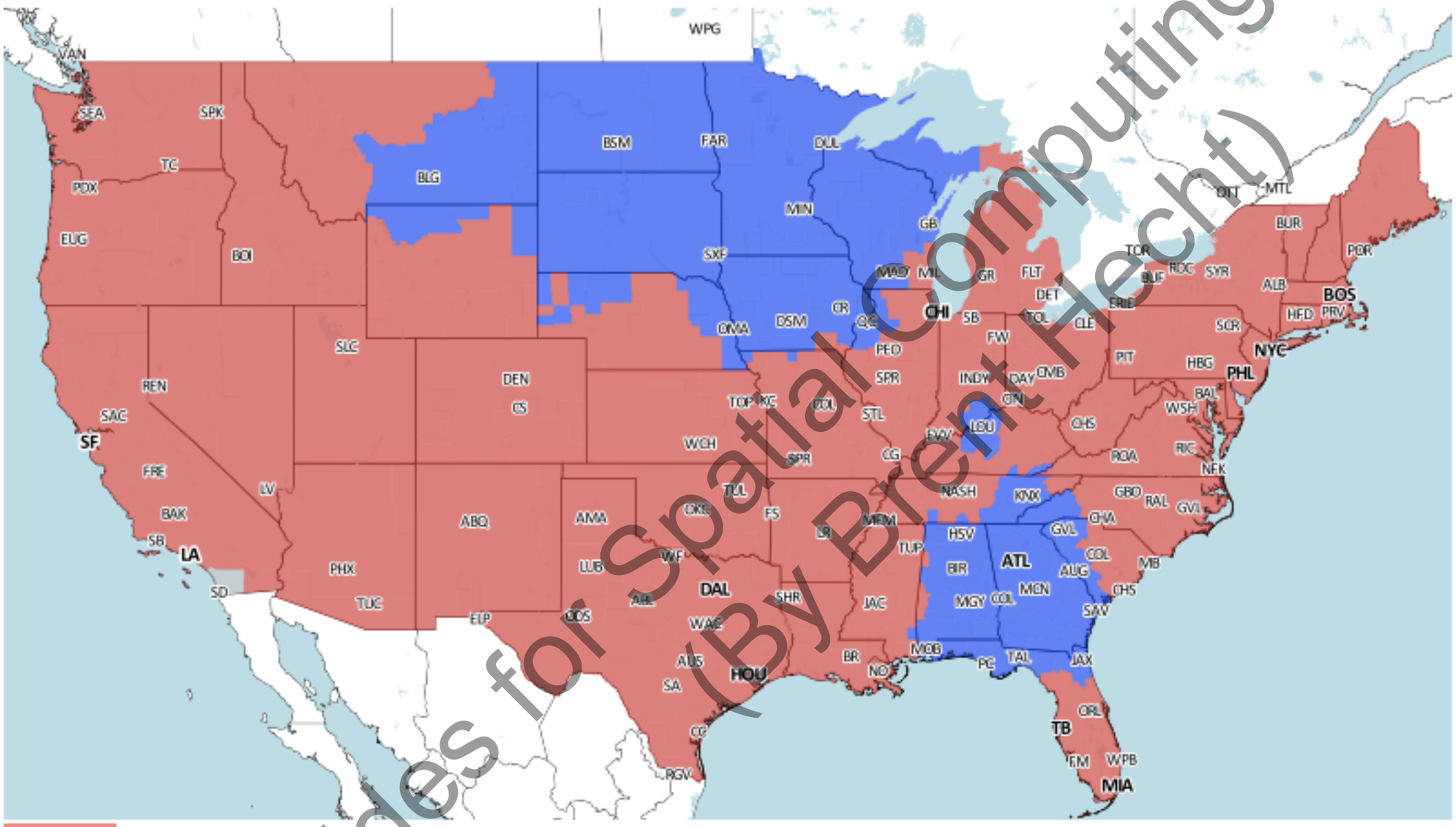


ALLIANCE		LEAD+RESULTS	CHANGE
	BJP+	123	+75
	SS	63	+19

http://www.ndtv.com/elections/general-election-results-2014

Honolulu HI: GB-CHI to DET-NYJ
Scranton PA: DET-NYJ to TB-PIT

FOX LATE

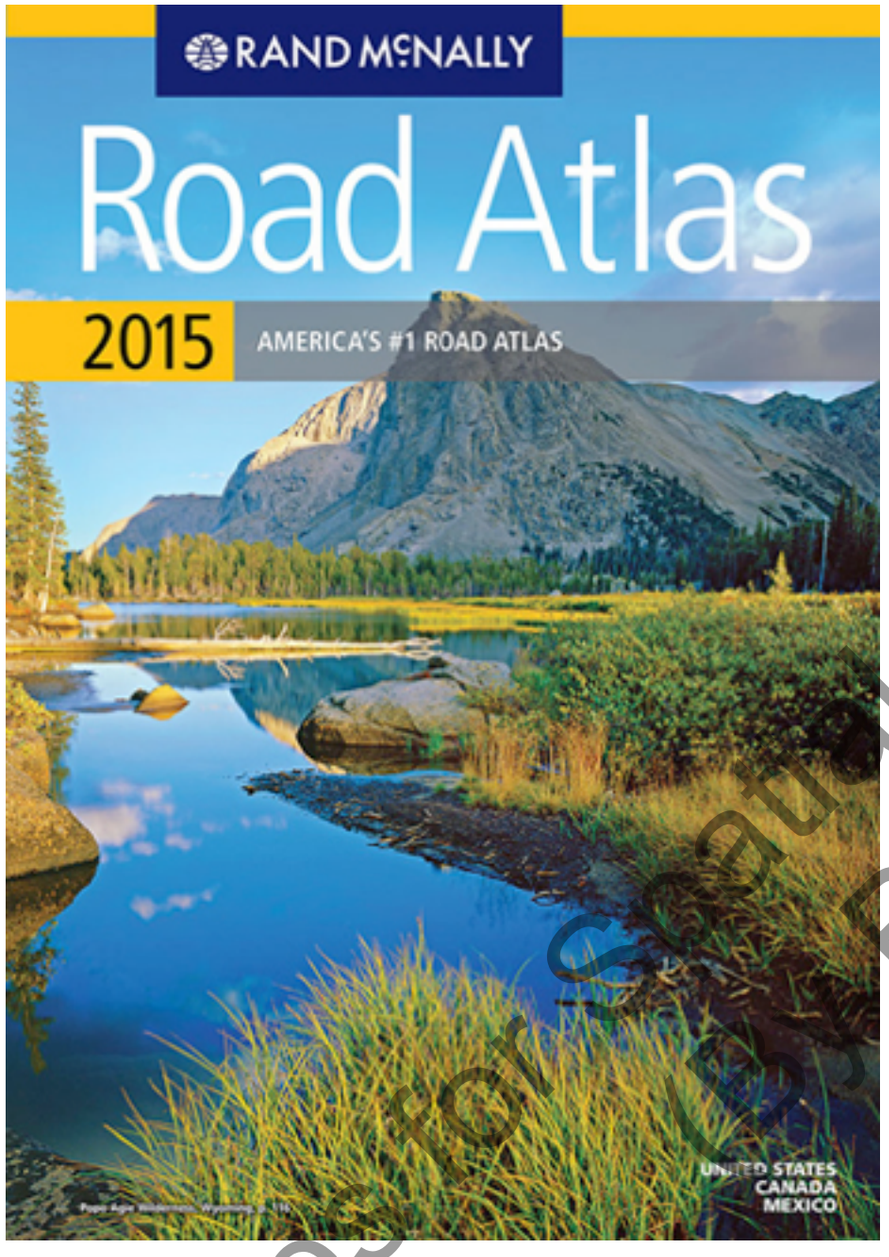


Philadelphia @ San Francisco -- Joe Buck, Troy Aikman [AK; HI]
Atlanta @ Minnesota -- Chris Myers, Ronde Barber

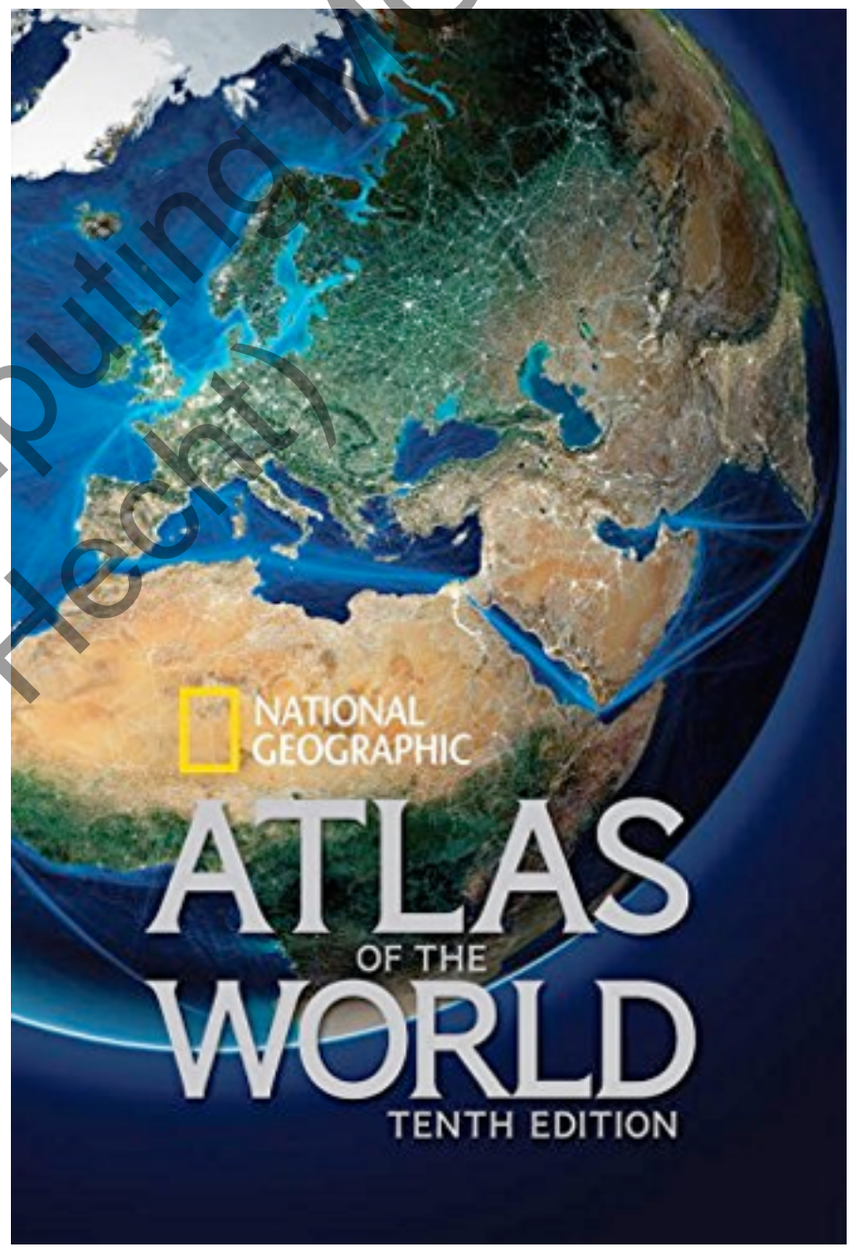
UPDATES:
Jacksonville and Panama City FL; Greenville SC; Knoxville TN; Mobile AL; Omaha NE; Cedar Rapids IA; Madison and Wausau WI; Marquette M

http://506sports.com/nfl.php?yr=2014&wk=4

Publicly-displayed local maps:



Road Atlases



World Atlases

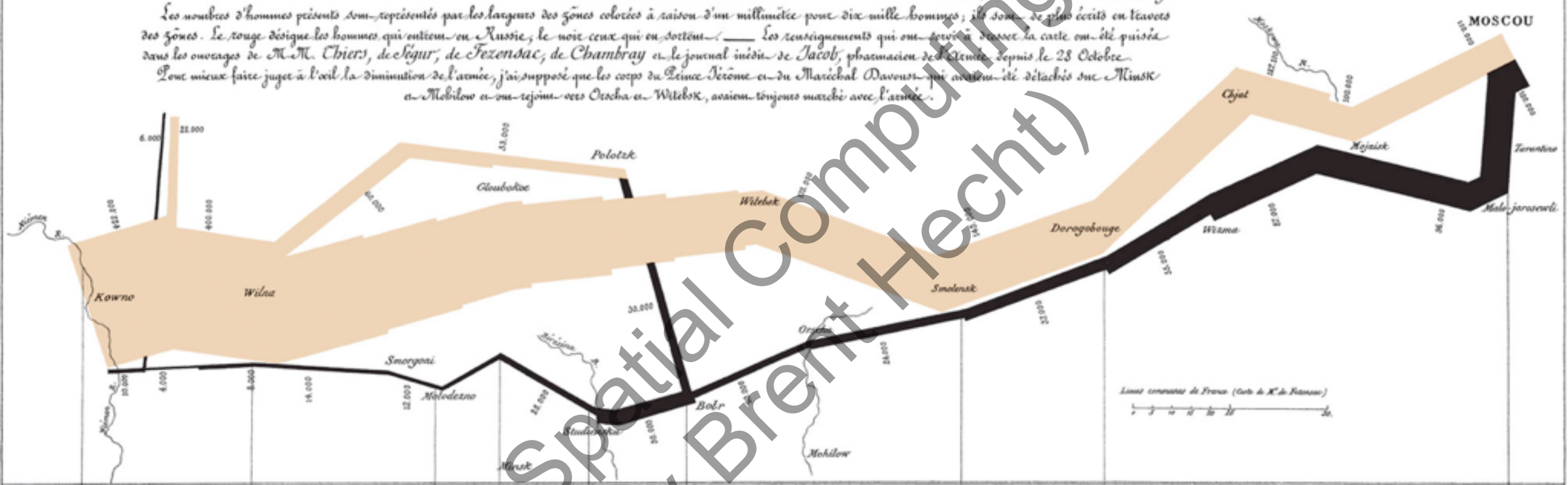
Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.

Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zônes colorées à raison d'un millimètre pour dix mille hommes ; ils sont de plus écrits en travers des zônes. Le rouge désigne les hommes qui entrèrent en Russie, le noir ceux qui en sortirent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de MM. Thiers, de Ségur, 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 Mohilow et qui rejoignirent vers Orscha et Witebsk, avaient toujours marché avec l'armée.



Autog. par Regnier, 8. Pas. Stre Marie St Gdre à Paris.

Imp. Lith. Regnier et Bourdet.

World's oldest map: Spanish cave has landscape from 14,000 years ago

Archaeologists have discovered what they believe is man's earliest map, dating from almost 14,000 years ago.

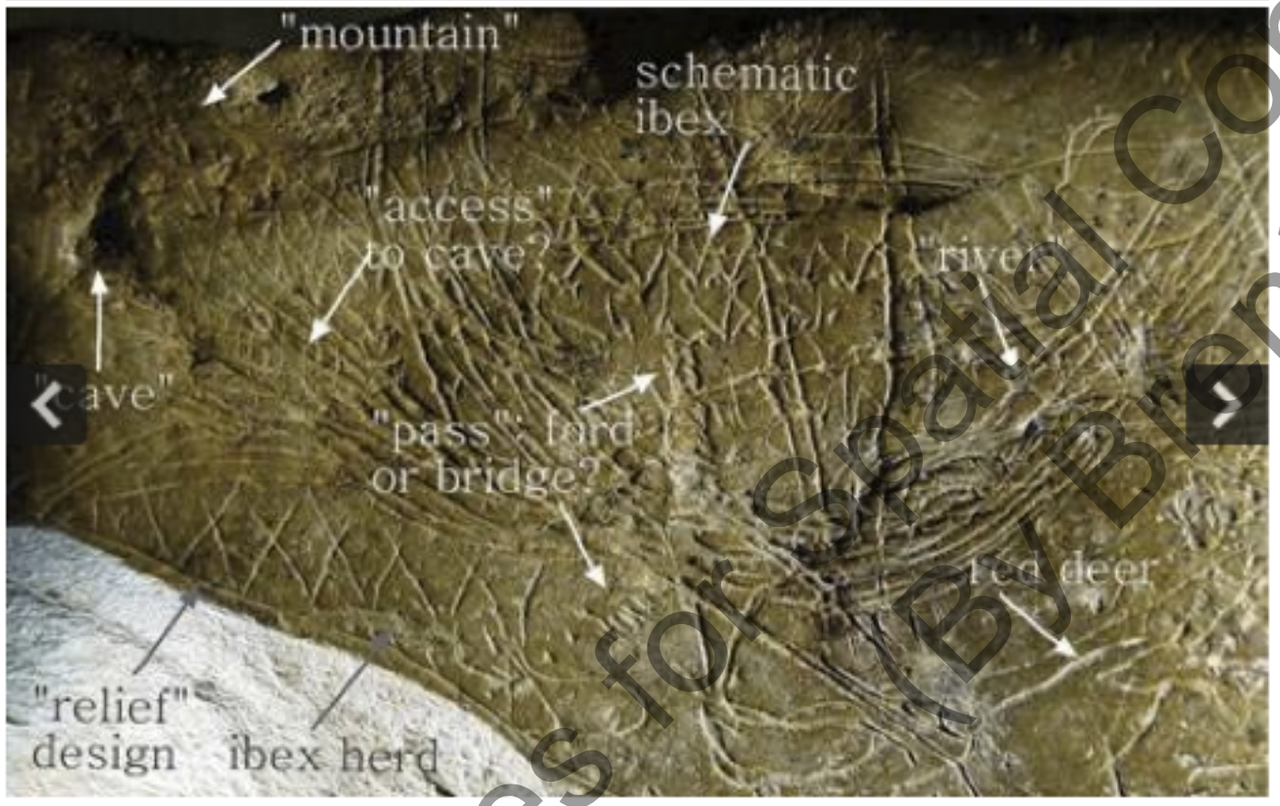


Image 1 of 2
Archaeologists have discovered what they believe is man's earliest map, dating from almost 14,000 years ago Photo: EPA

By Fiona Govan in Madrid
7:30AM BST 06 Aug 2009

A stone tablet found in a cave in Abauntz in the Navarra region of northern Spain is believed to contain the earliest known representation of

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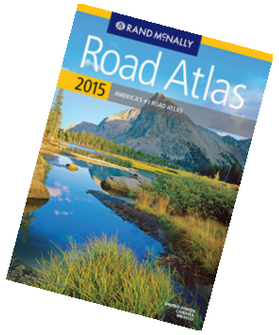
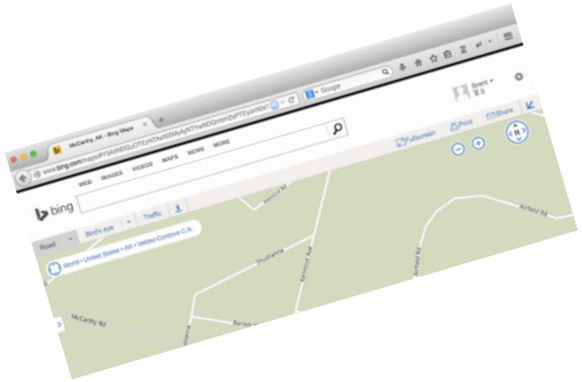
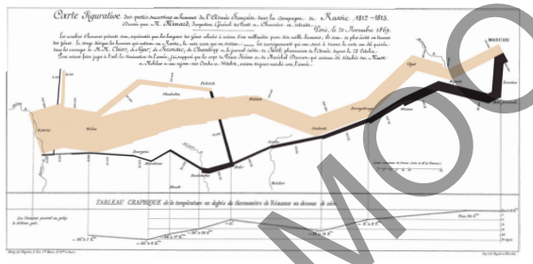
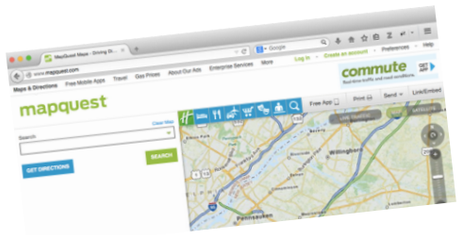
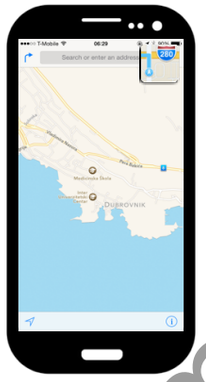
In Spain

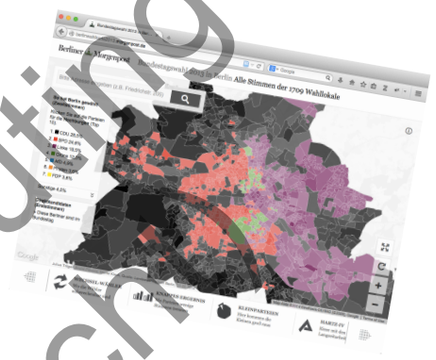


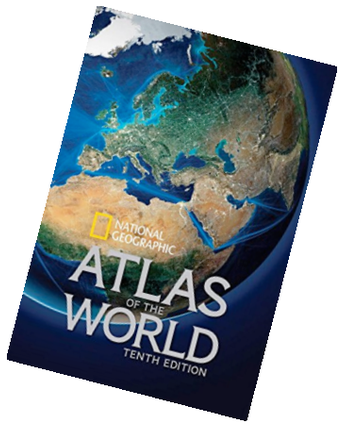


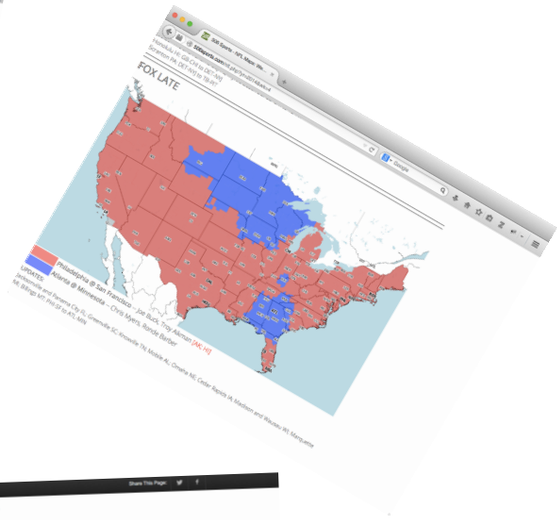


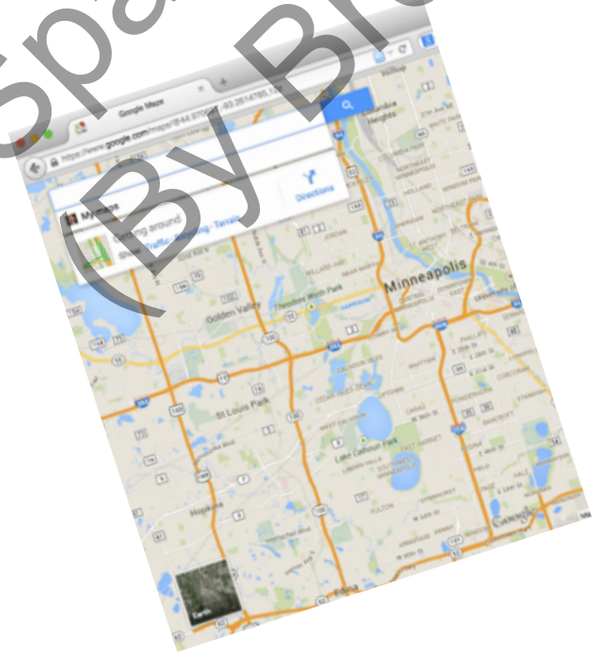


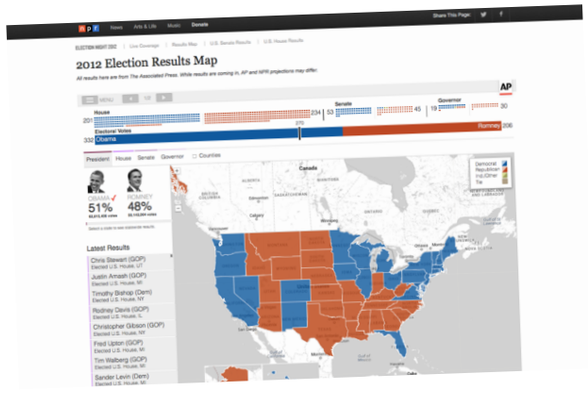


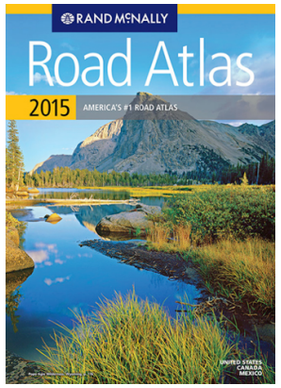


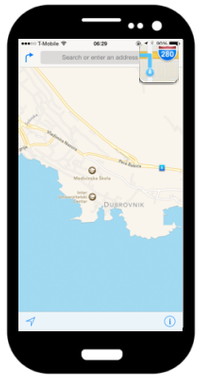


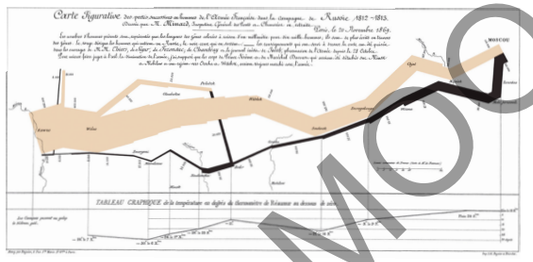


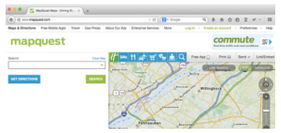


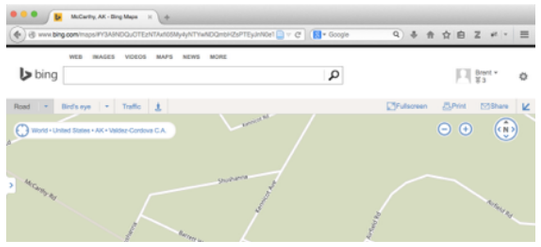


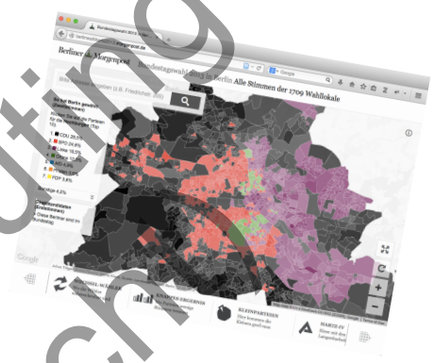


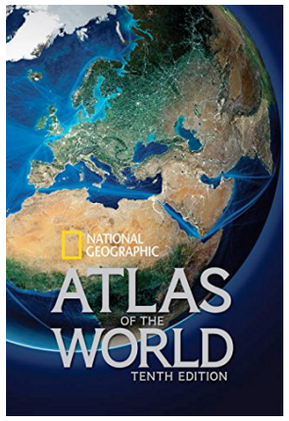


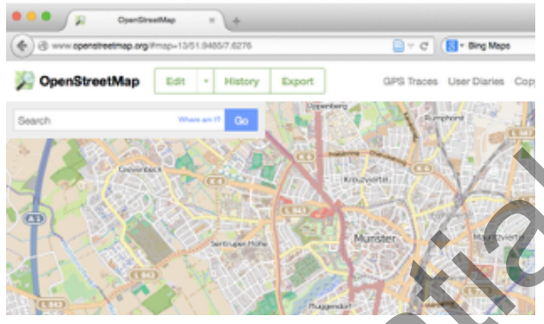


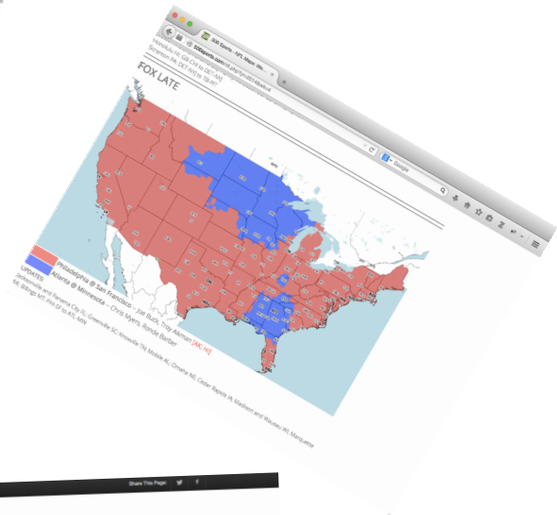


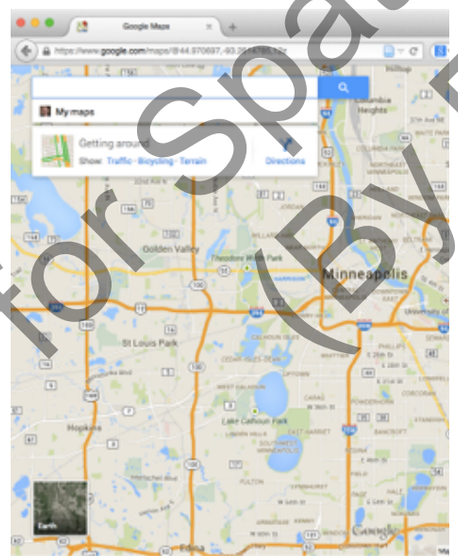


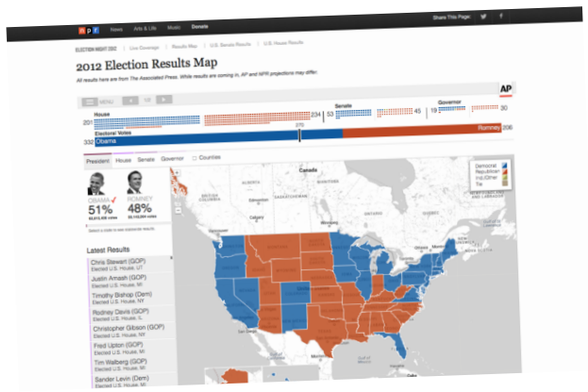




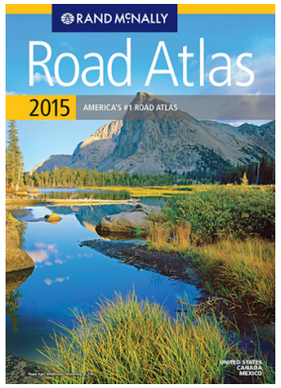


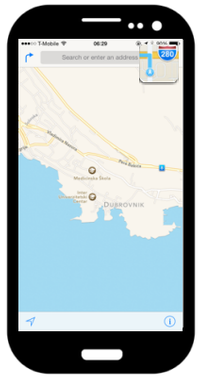


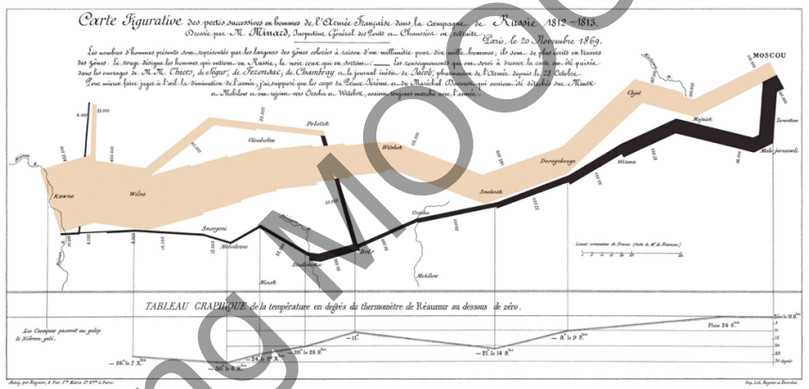


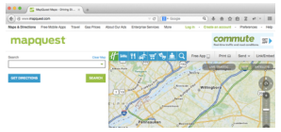


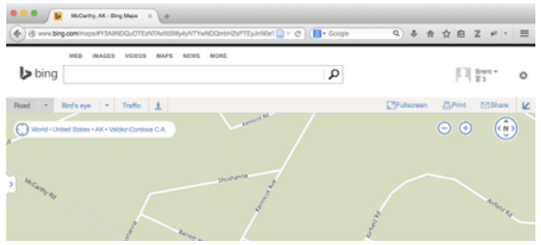
Reference Maps

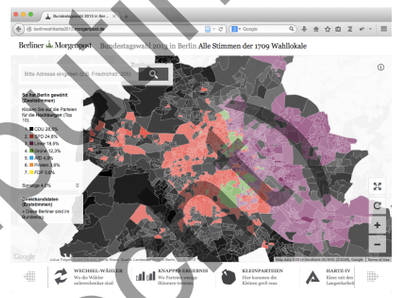


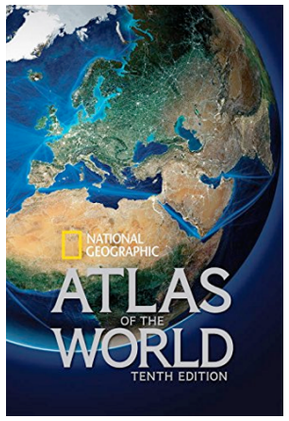


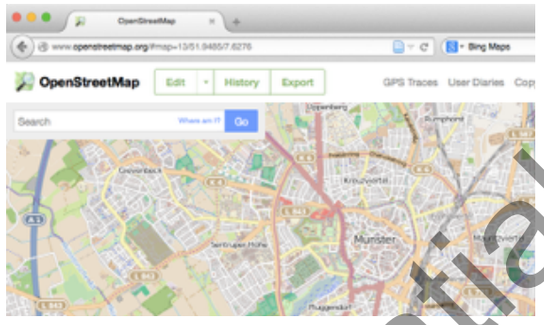


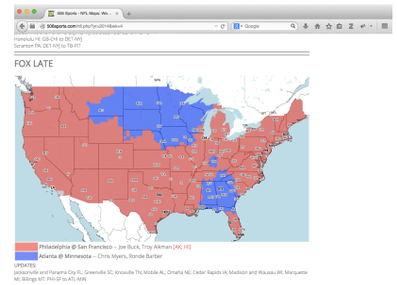


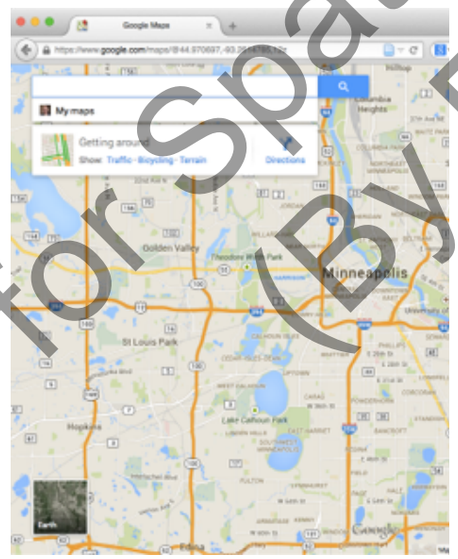


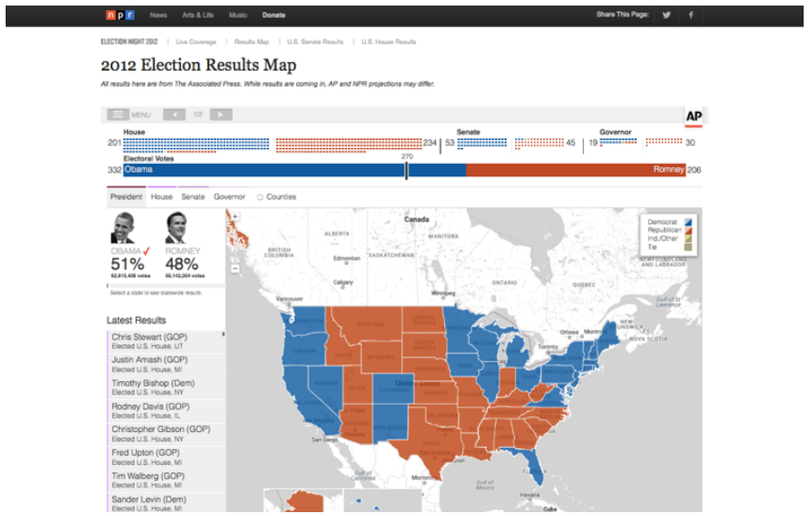






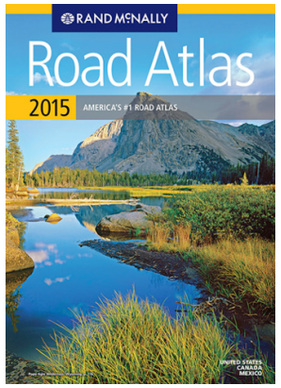


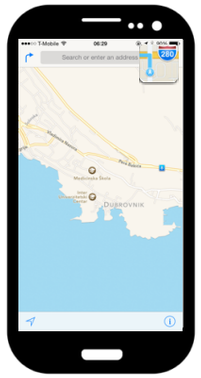


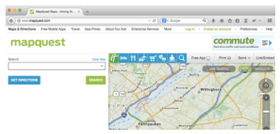


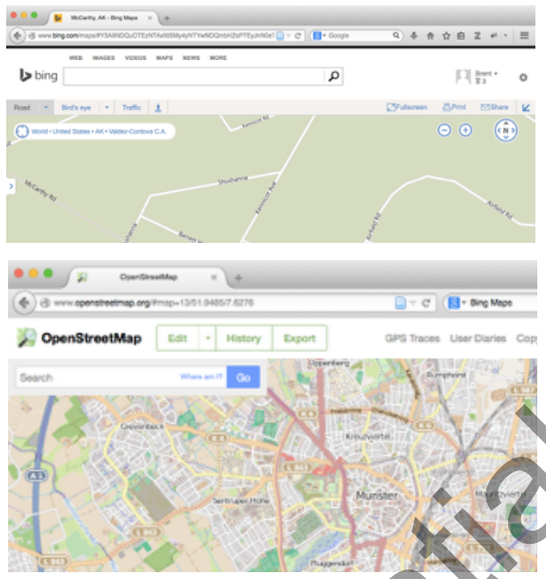
Reference Maps

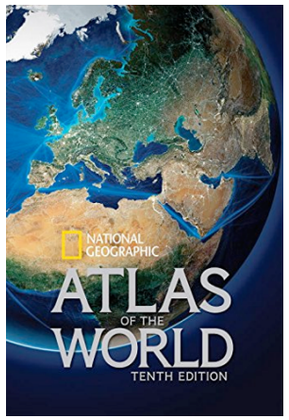
Thematic Maps

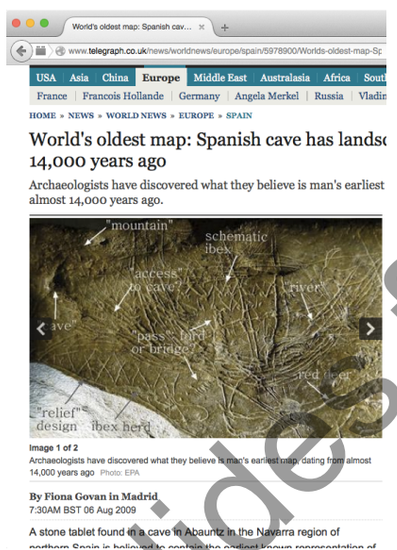


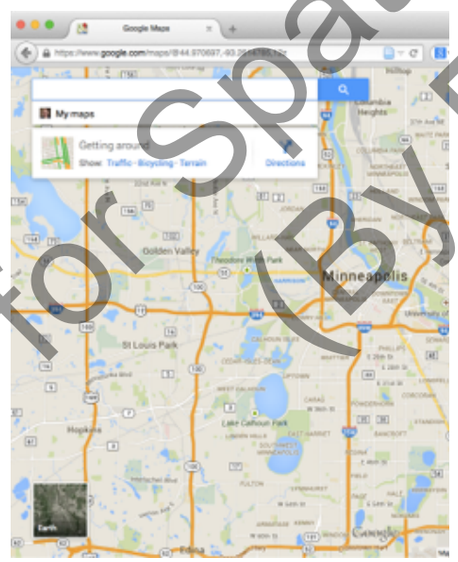












Reference Maps

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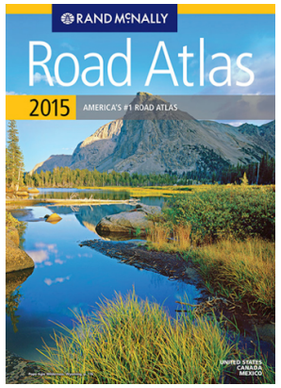
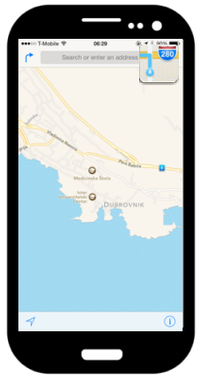
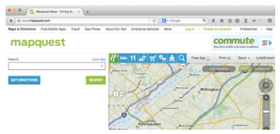
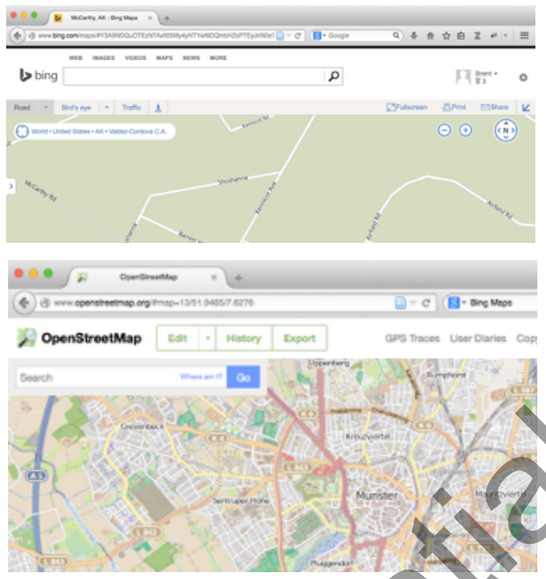
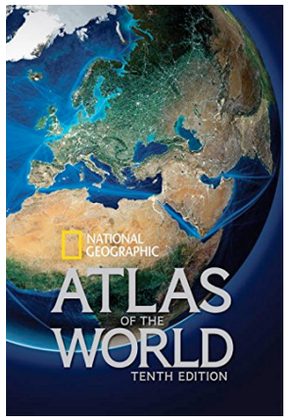
Used primarily for **navigation** and **orientation**

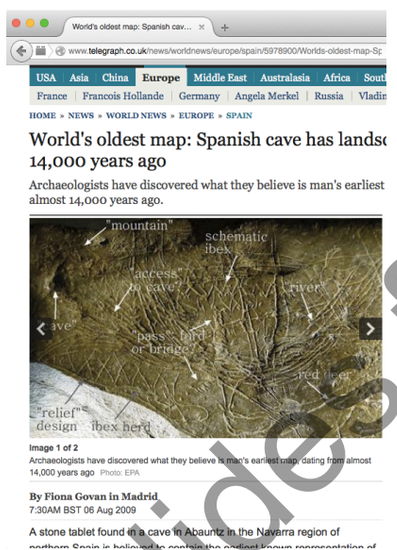


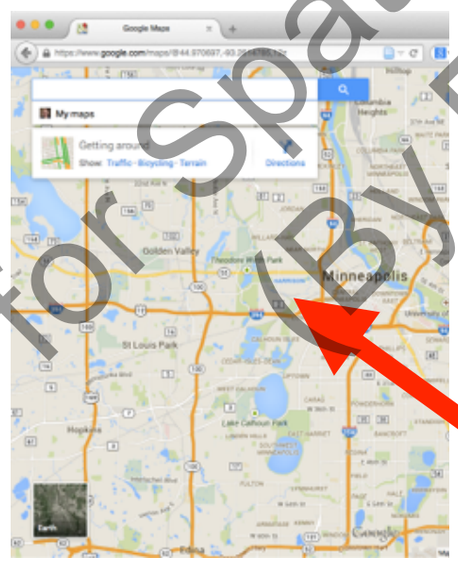












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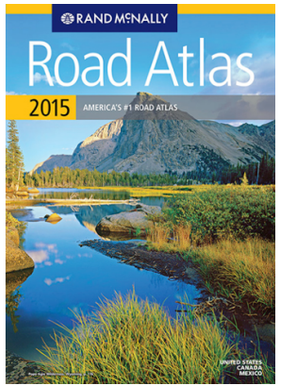

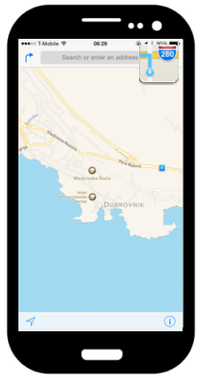

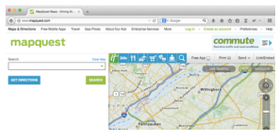

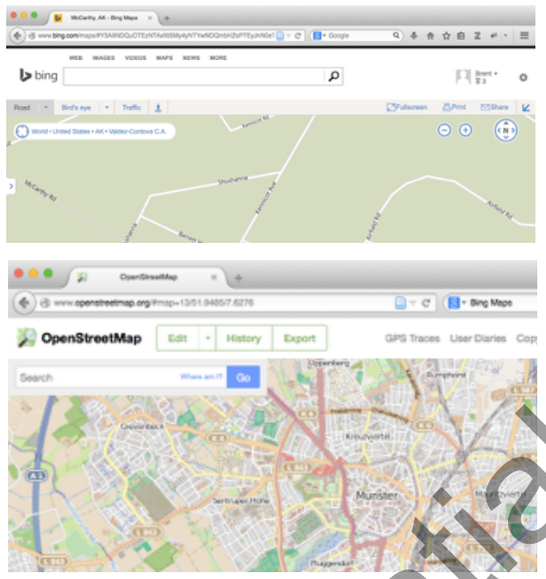

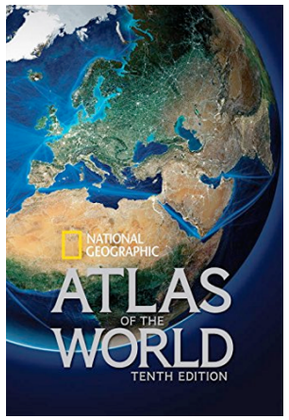

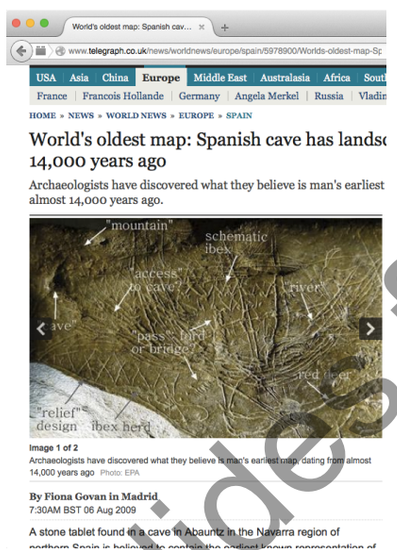

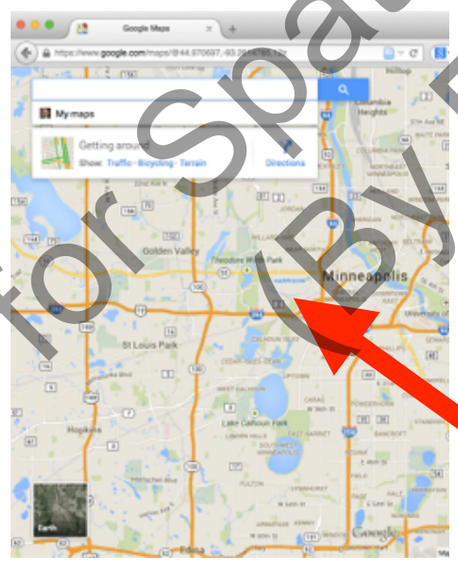

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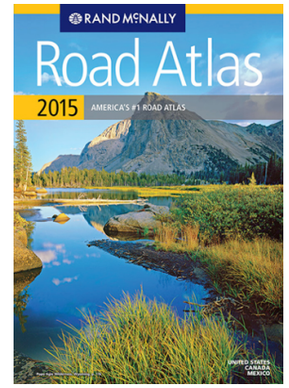

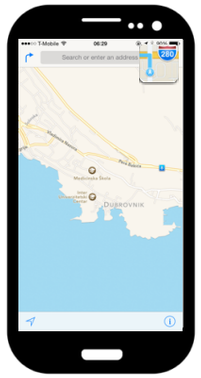

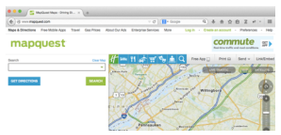

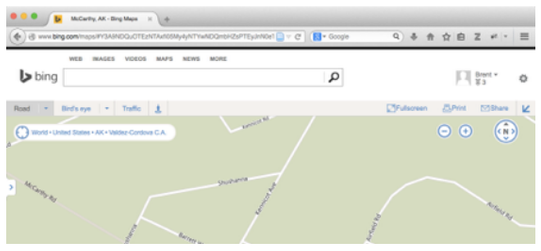

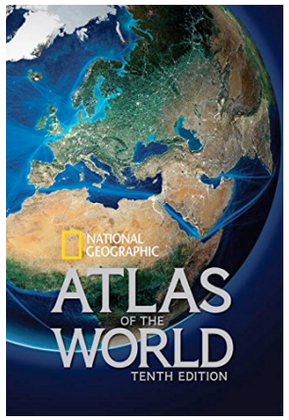

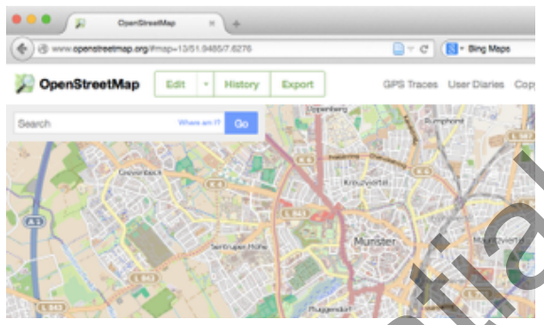

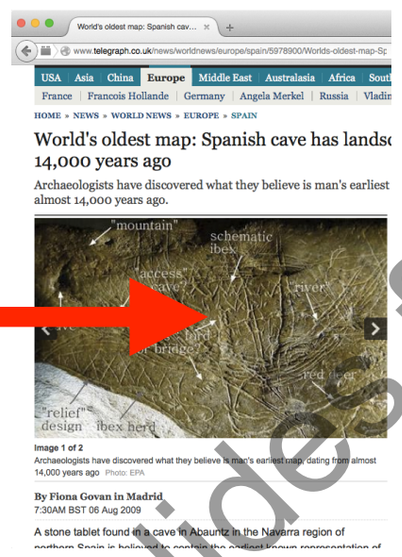

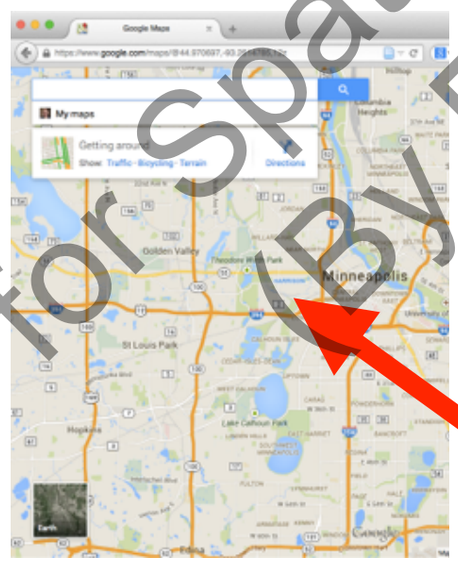

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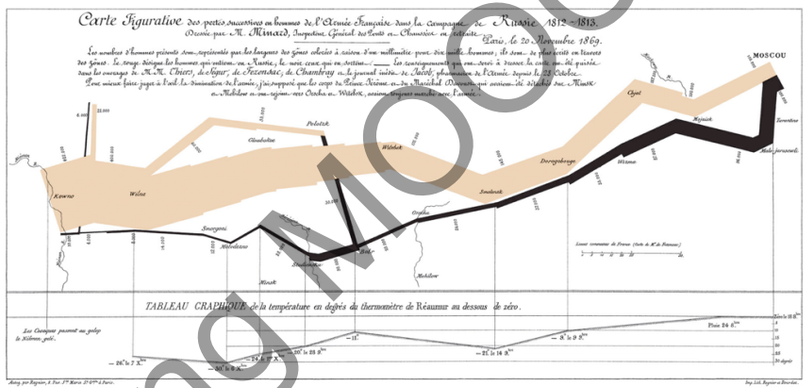
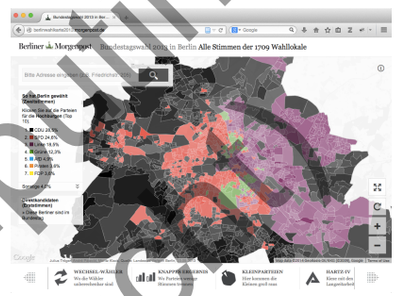
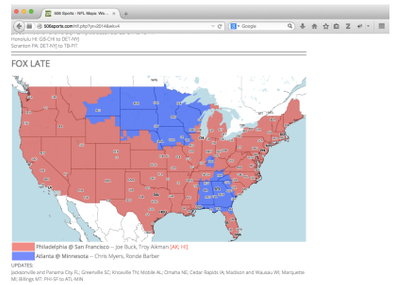
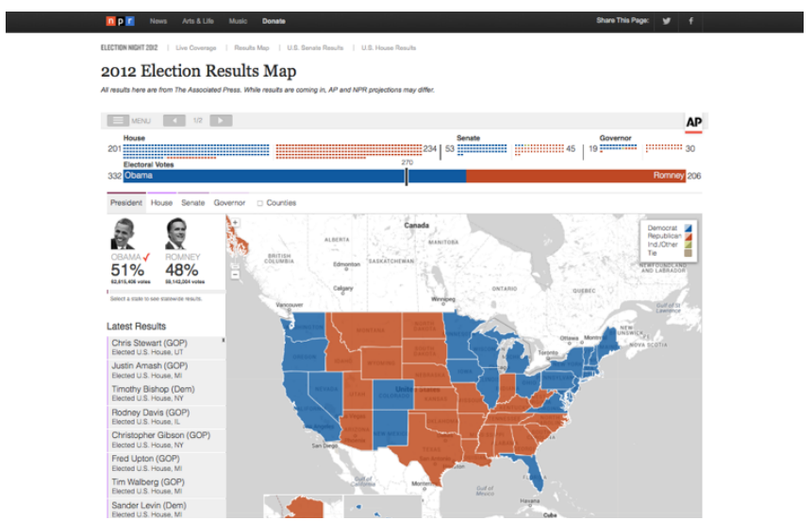
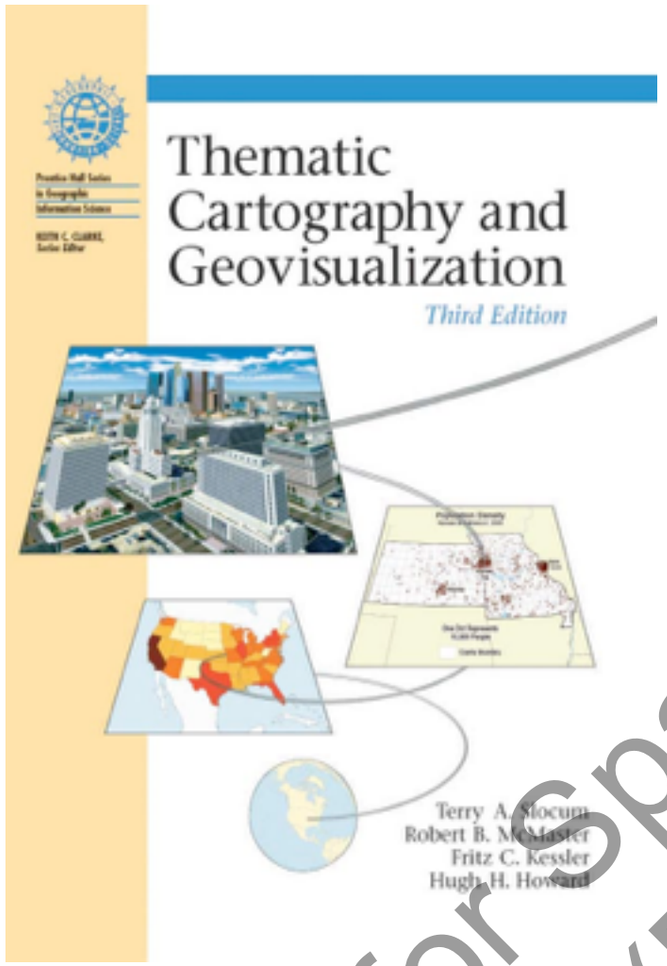








Thematic Maps



(Slocum et al. 2009)

Thematic maps are “used to emphasize the **spatial distribution** of one or more geographic attributes”.

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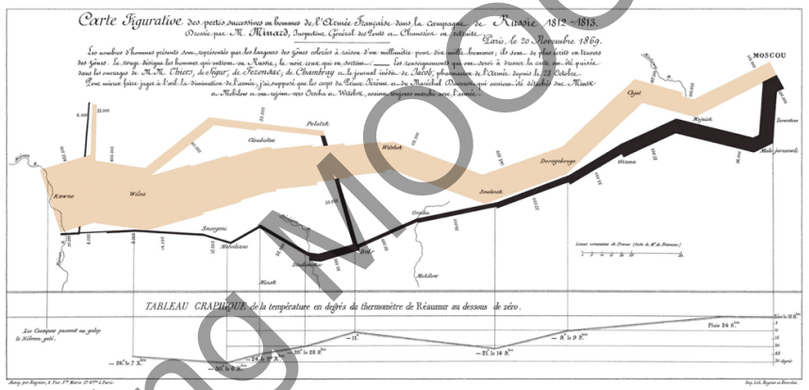
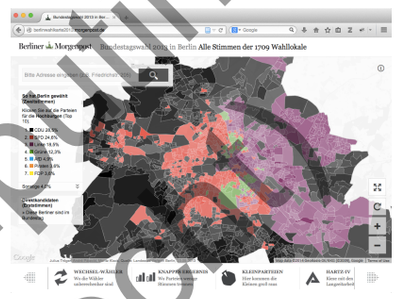
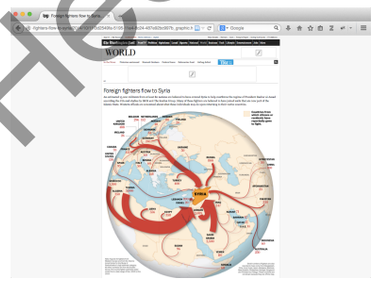
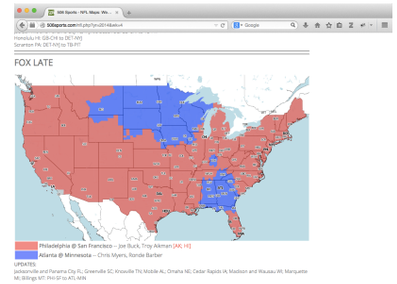
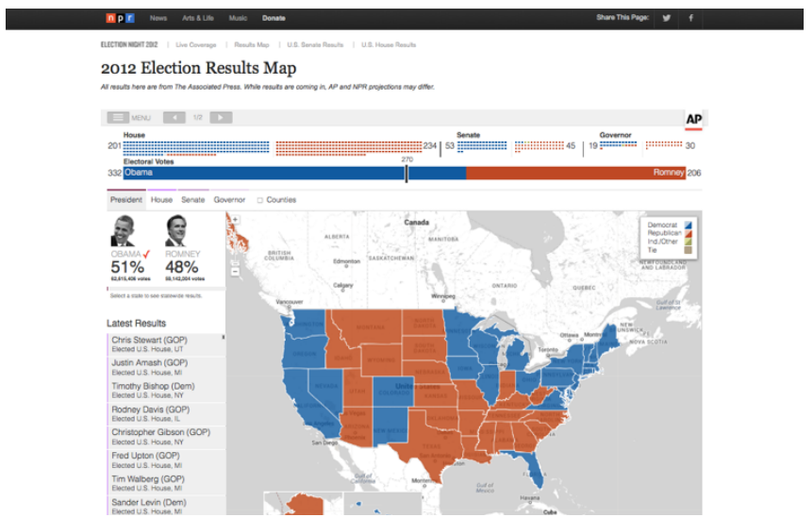




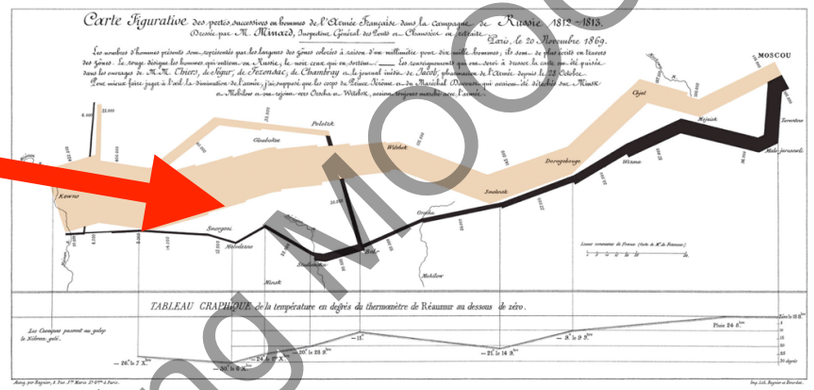






Thematic Maps

The size of an army



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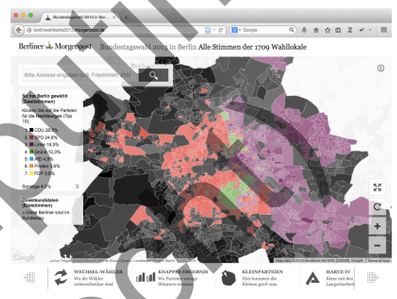

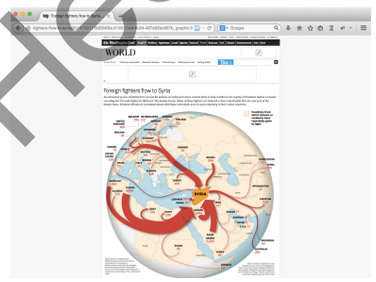

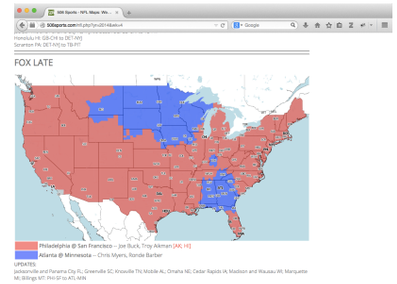

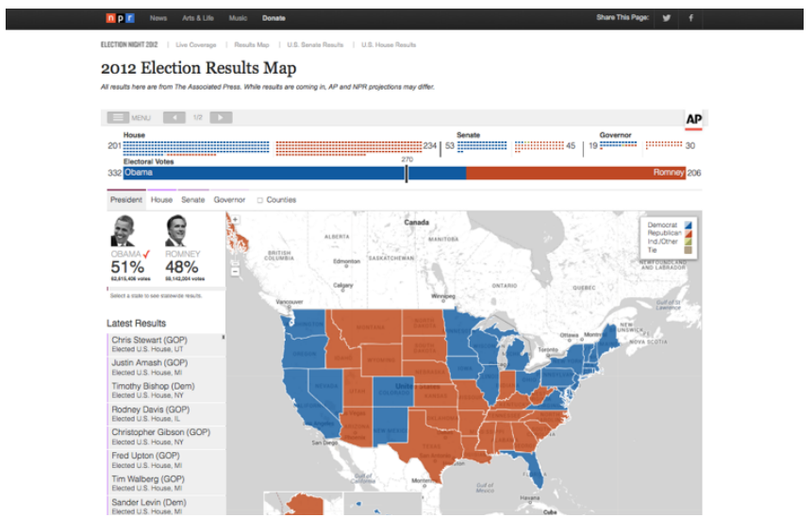

Thematic Maps

The size of an army

Where an army comes from

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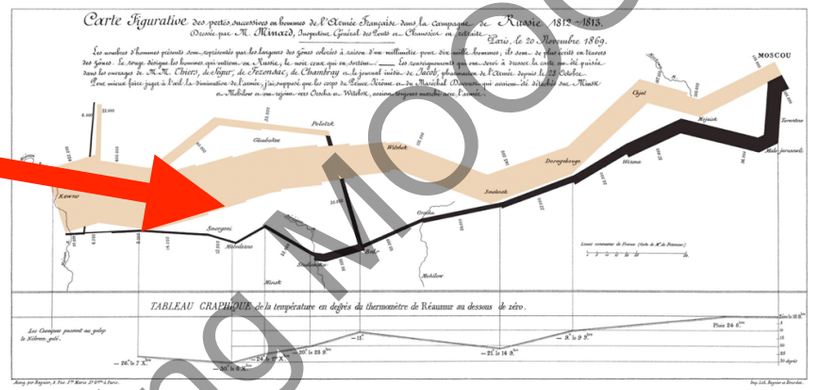
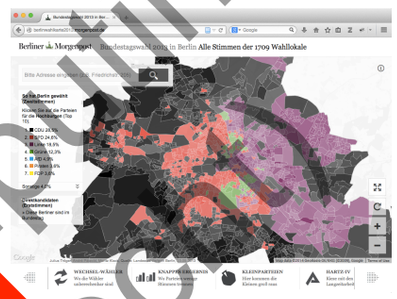
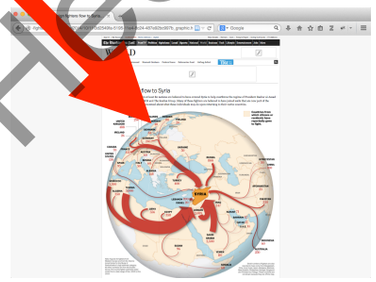
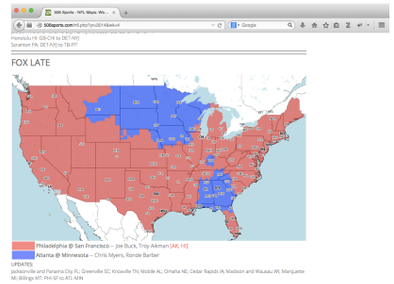
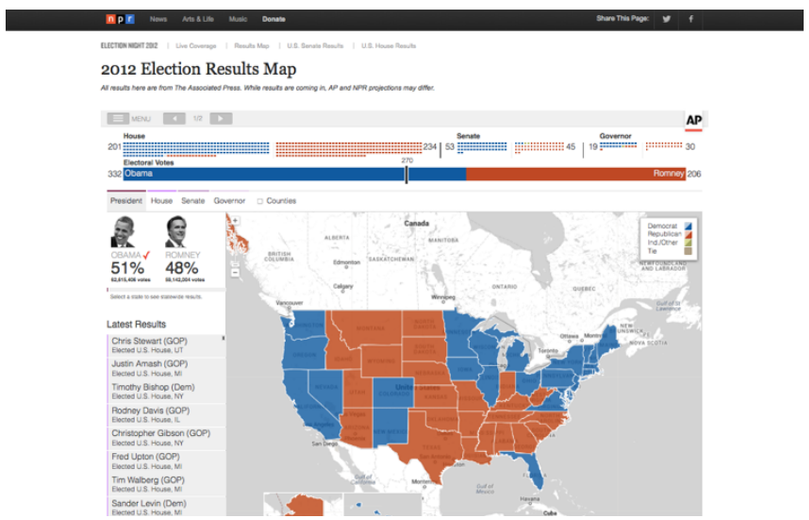










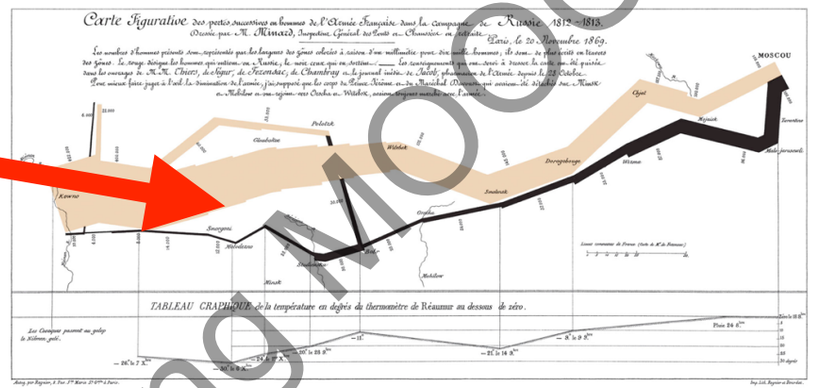
Thematic Maps

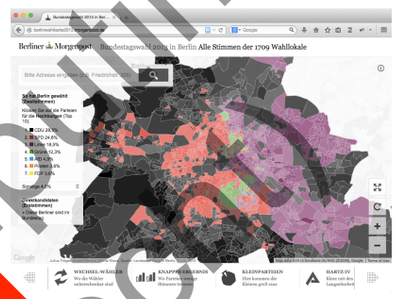
The size of an army

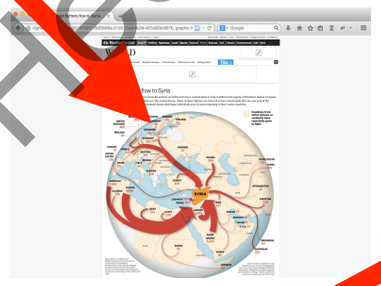
Where an army comes from

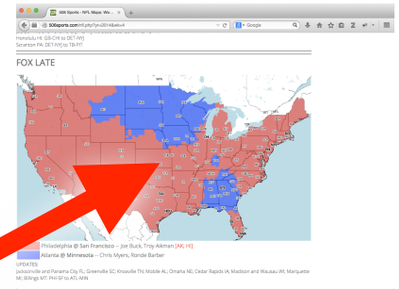
Thematic maps are “used to emphasize the **spatial distribution** of one or more geographic attributes”.

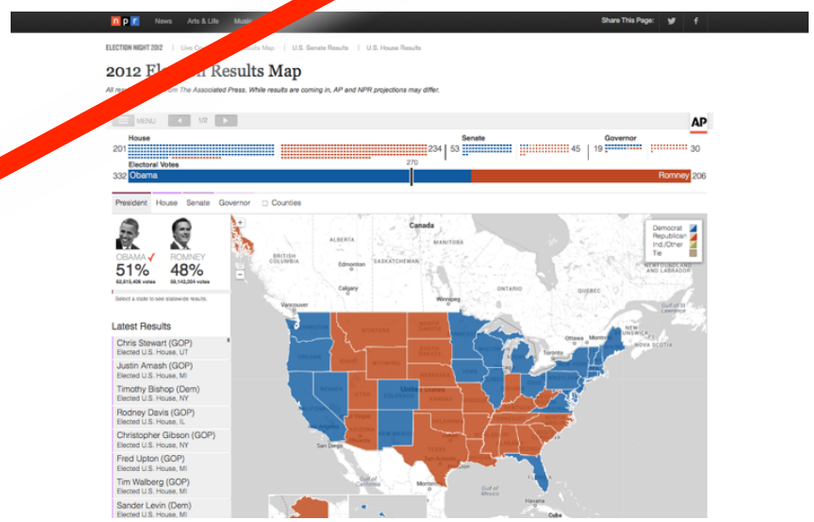
Which football game is on TV











Thematic Maps

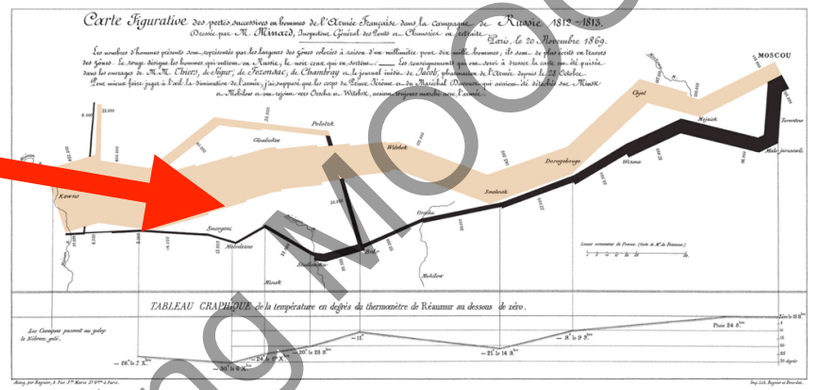
The size of an army

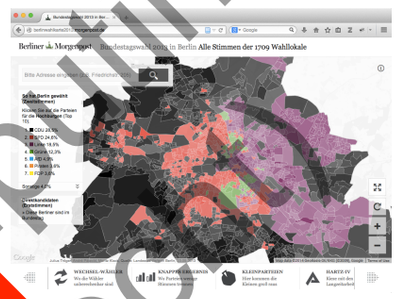
Where an army comes from

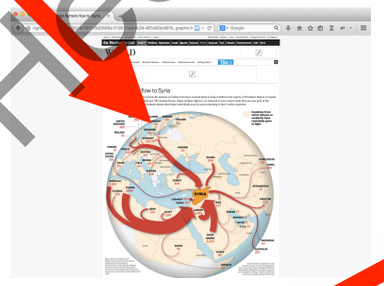
Thematic maps are “used to emphasize the **spatial distribution** of one or more geographic attributes”.

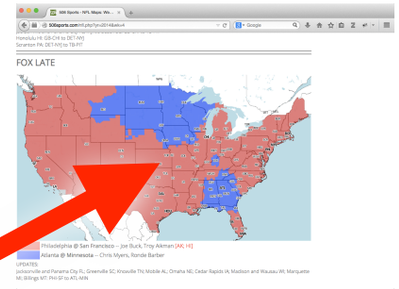
Which football game is on TV

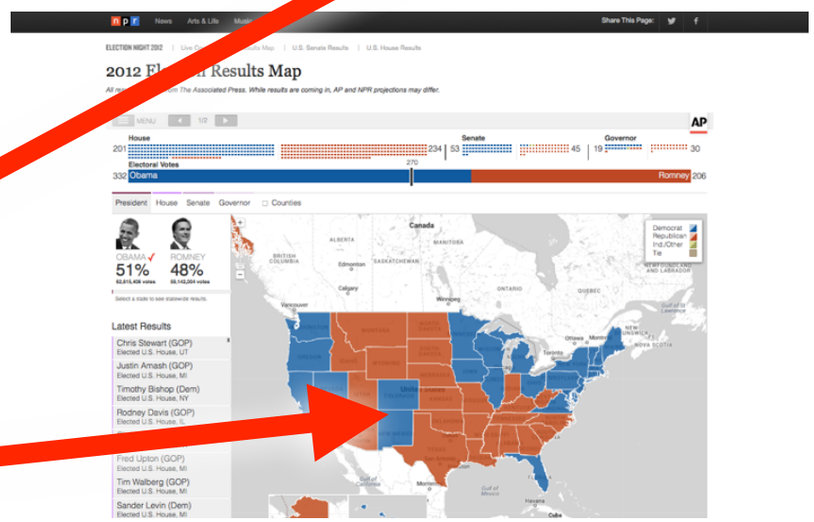
Election results











Thematic Maps

Intended to (geo)communicate the **location of specific entities** (and how to get to them)

Used primarily for **navigation** and **orientation**

Reference Maps

Thematic maps are "used to emphasize the **spatial distribution** of one or more geographic attributes".

Thematic Maps

(Muehlenhaus 2013)

(Muehlenhaus 2013)

"The last time cartography went through such a **sea change** was with the **advent of thematic mapping**."

(Muehlenhaus 2013)

korean bbq - Google Maps

https://www.google.com/maps/search/korean+bbq/@41.9317906,-87.6544787,14z

Google

korean bbq

Showing all results for **korean bbq**

+Brent

Share

Rice'N Bread
American diner fare with a Korean flair

La Tacorea
Casual stop for Asian-inspired tacos

Crisp
Counter-service Korean food

Pei Wei Asian Diner
Health-minded, casual Pan-Asian chain

Del Seoul
Korean fusion fast food

Korean BBQ Inc

Belly Shack

En Hakkore
Hip, counter-service

Thee Asian Restaurant
Standard option for

Wrigley Field

Belmont Harbor

Apollo Theater Chicago

Lakeview Associates, Inc

Oz Park

Lincoln Park Zoo

LAKE VIEW

LINCOLN PARK

W Waveland Ave
W Addison St
W Cornelia Ave
W School St
W Belmont Ave
W Barry Ave
W Wellington Ave
W Wrightwood Ave
W Belden Ave
W Armitage Ave
W Cortland St
W Dickens Ave
W Altgeld St
N Elston Ave
N Milwaukee Ave
Kennedy Expy
N Lake Shore Dr

Map data ©2014 Google Terms Privacy Report a problem 2000 ft

Potential point of confusion: thematic or reference?

Cartography

Spatial Computing – University of Minnesota

Learning Objectives

1. Understand the drastically **changed** (and changing) **professional context** of modern cartography.
2. Be able to distinguish between and understand the purpose of the two major types of maps: **reference and thematic**.
3. Know the **limitations** of popular online and mobile **reference maps**. (Technical track: Know how to get around them)
4. Be able to distinguish between types of **thematic maps** and choose the correct type for a given ***geocommunication*** need.
5. Have an understanding of some of the **computing-oriented innovation** going on in cartography (i.e. ***spatialization***)

Cartography

Spatial Computing – University of Minnesota

Attributions

Cartography

Spatial Computing – University of Minnesota

Cartography

Spatial Computing – University of Minnesota

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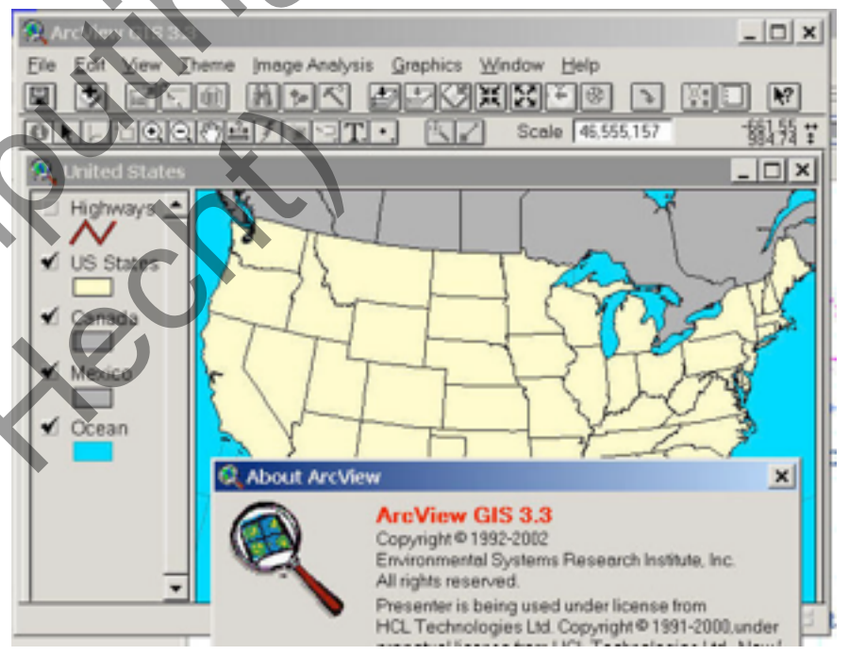
Phonebook



Geographic Information System

(e.g. ArcMap 3.3)

http://map.sdsu.edu/geog581/week_02.htm

Google Maps

https://www.google.com/maps/@37.8591303,-122.2686253,13z

Google

Traffic, Transit, Bicycling, Terrain, Directions

+Brent

Albany
BERKELEY HILLS
Solano Ave
Tilden Regional Park
Camino Pablo
Gilman St
Hopkins St
6th St
M.L.K. Jr Way
Shattuck Ave
Hearst Ave
University Ave
University of California, Berkeley
Claremont Canyon Regional Preserve
Siesta Valley Recreation Area
PANORAMIC HILL
Dwight Way
Telegraph Ave
College Ave
CLAREMONT
7th St
65th St
Alcatraz Ave
Claremont Ave
Grove Shafter Fwy
North Oakland Regional Sports Center
Huckleberry Botanic Regional Preserve
GOLDEN GATE
Powell St
Adeline St
Broadway Terrace
Broadway
51st St
Mountain View Cemetery
TEMESCAL
Emeryville
LONGFELLOW
Motaga Ave
Shepherd Canyon Rd
MONTCLAIR
PIEDMONT AVENUE
PIEDMONT PINES
CLAWSON
Oakland Ave
Piedmont
W Grand Ave
WEST OAKLAND
GRAND LAKE
Earth
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Privacy
Report a problem
1 mi

japanese food - Google Maps

https://www.google.com/maps/search/japanese+food/@37.8591303,-122.2686253,13z/d

Google

japanese food

Price ▾ Rating ▾ Hours ▾ More ▾

Geta Japanese Restaurant
4.3 ★★★★½ 62 reviews · Japanese Restaurant
Tiny sushi spot with a big Japanese menu
165 41st St, Oakland, CA 94611

Cha-Ya
4.3 ★★★★½ 50 reviews · Japanese Restaurant
Japanese eats for vegans & vegetarians
1686 Shattuck Ave, Berkeley, CA 94709

Mijori
4.4 ★★★★½ 25 reviews · Japanese Restaurant
Bustling pick for Japanese mains & sushi
3260 Grand Ave, Oakland, CA 94610

Kirala

See results in list view

+Brent

Miyuki Japanese Restaurant
Casual spot for sushi...

Tilden Regional Park

Camino Pablo

Hanazen
Cozy sushi with elevate

Cha-Ya
Japanese eats for vegans & vegetarians

C U Japanese Fusion
Cozy spot for sushi & Japanese standards

Claremont Canyon Regional Preserve

Siesta Valley Recreation Area

PANORAMIC HILL

Kirala
Local favorite for sushi & robata

CLAREMONT

Mitama
Chic, modern spot for Japanese cuisine

North Oakland Regional Sports Center

Huckleberry Botanic Regional Preserve

Rikyu Japanese Restaurant
Sushi bar, hot entrees...

Shimizu Japanese Cuisine
Sushi hangout with varied Japanese fare

Geta Japanese Restaurant
Tiny sushi spot with a big Japanese menu

Emeryville

LONGFELLOW

CLAWSON

WEST OAKLAND

GRAND LAKE

MONTCLAIR

PIEDMONT PINES

Piedmont

Oakland Ave

Broadway Terrace

Shepherd Canyon Rd

Alcatraz Ave

Powell St

Adeline St

Shattuck Ave

M.L.K. Jr Way

W Grand Ave

Earth

Google

Map data ©2014 Google Terms Privacy Report a problem 1 mi

Google Maps

https://www.google.com/maps/dir/Memorial+Park,+1325+Portland+Ave,+Albany,+CA+94

Google

Memorial Park, 1325 Portland Ave, Albany, CA 94

Geta Japanese Restaurant, 165 41st St, Oakland

Route options

via Sacramento St — 27 min

21 min without traffic · Show traffic — 6.4 miles

List all steps — Preview steps

via I-580 E/I-80 W — 34 min

49 min

+Brent

Memorial Park

BERKELEY HILLS

Tilden Regional Park

Solano Ave

Albany

Gilman St

University Ave

Hearst Ave

University of California, Berkeley

Claremont Ca

Regional Pres

PANORAMIC

27 min
6.4 miles

34 min
8.2 miles

49 min
every 8 min

CLAREMONT

Alcatraz Ave

Grove Shafter Fwy

65th St

GOLDEN GATE

Powell St

Emeryville

CLAWSON

TEMESCAL

Broadway Terrace

Mountain View Cemeter

Geta Japan Resta

Earth

Treasure Island

Google

Map data ©2014 Google Terms Privacy Report a problem 1 mi

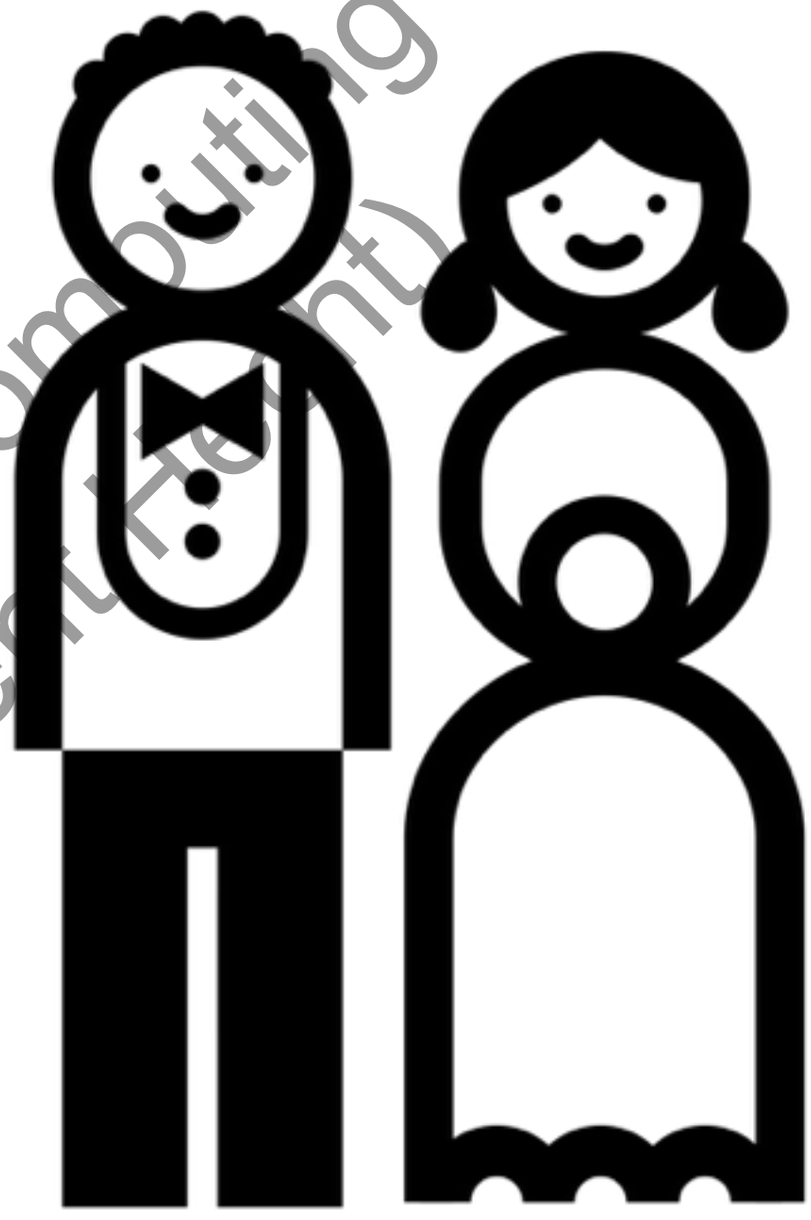
WEDDING EVENTS:

Ceremony
The Wit Hotel
201 N. State St.
Chicago, IL 60610

Reception
Signature Room
John Hancock Center
875 N. Michigan Ave.
Chicago, IL 60611

Main Hotel
The Drake Hotel
140 E. Walton Pl.
Chicago, IL 60611

Brunch
Wiener Circle
2622 N. Clark St.
Chicago, IL 60614



Wedding by Ivan Colic from The Noun Project

My Maps

https://mapsengine.google.com/map/u/0/

Google

+Brent Search Images Maps Play YouTube News Gmail More

Welcome to the new My Maps

Create a new map

Open a map

mymaps.google.com

Bad Wedding

https://www.google.com/maps/d/u/0/edit?mid=zItiMzPdjRfg.k3eF3uyvfCbA

Google

+Brent Search Images Maps Play YouTube News Gmail More

Bad Wedding

Add layer Saved

Untitled layer

Style Data Labels

- theWit- A Doubletree By Hilton
- John Hancock Center
- The Drake Hotel
- The Wieners Circle

Directions from The Drake Hotel to T...

Directions from The Drake Hotel to t...

Base map

Share

Wrigley Field
W Addison St
N Lincoln Ave
N Sheffield Ave
N Halsted St
N Larrabee St
W Fullerton Pkwy
LINCOLN PARK
W Armitage Ave
Lincoln Park Zoo
Steppenwolf Theatre
Chicago History Museum
Goose Island
W Division St
NEAR NORTH SIDE
Water Tower Place
W Chicago Ave
WEST TOWN
W Grand Ave
Kennedy Expy
N Ogden Ave
W Ohio St
STREETERVILLE
E Illinois St
Navy Pier
W Kinzie St
W Lake St
W Randolph St
EAST GARFIELD PARK
United Center
NEAR WEST SIDE
Willis Tower
GREEKTOWN
Dwight D. Eisenhower Expy
S Columbus Dr
S Canal St
S State St
ILLINOIS MEDICAL DISTRICT
UNIVERSITY VILLAGE / LITTLE ITALY
Shedd Aquarium
N Central Park Ave
N Homan Ave
N Kedzie Ave
N Sacramento Blvd
S Kedzie Ave
S California Ave

Google

Map data ©2014 Google Terms

www.google.com/intl/en/options/

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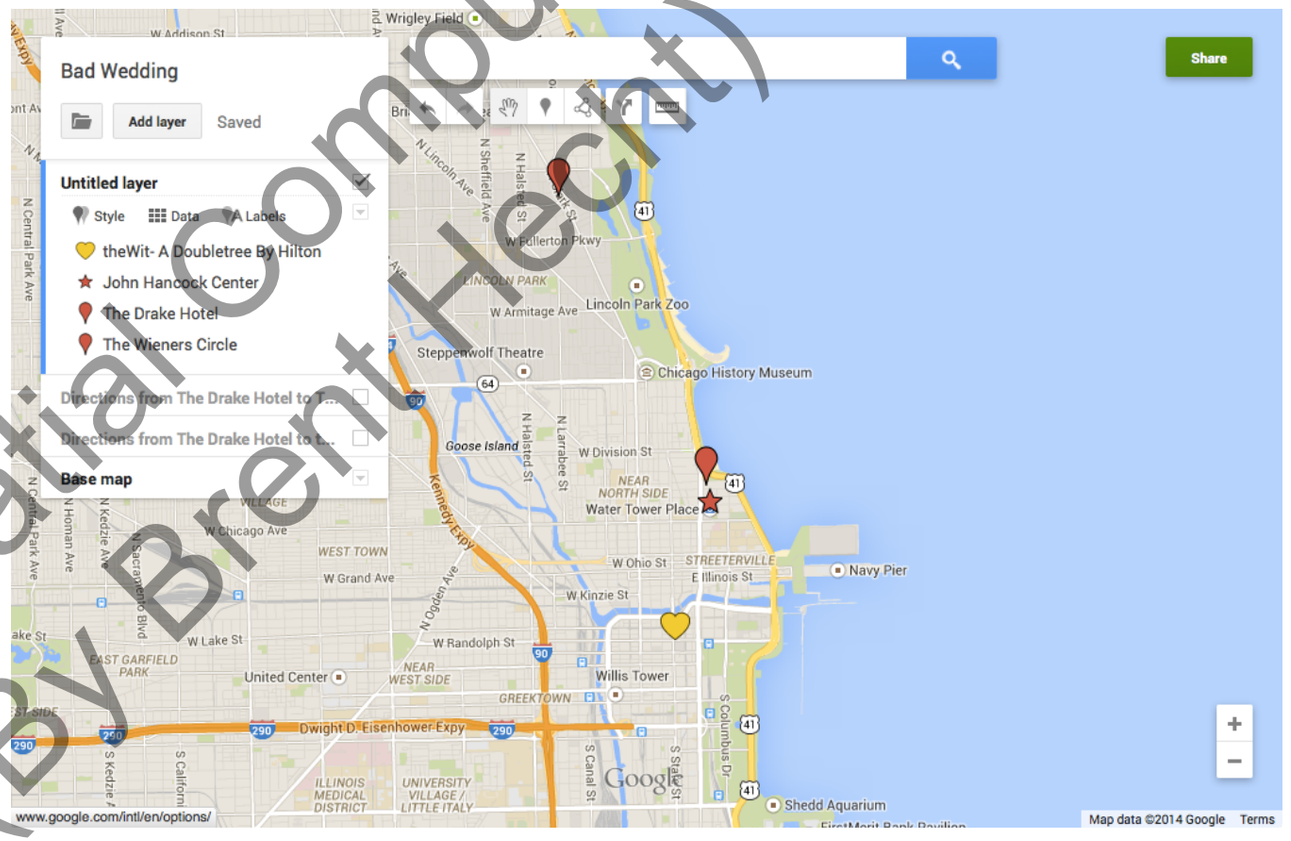

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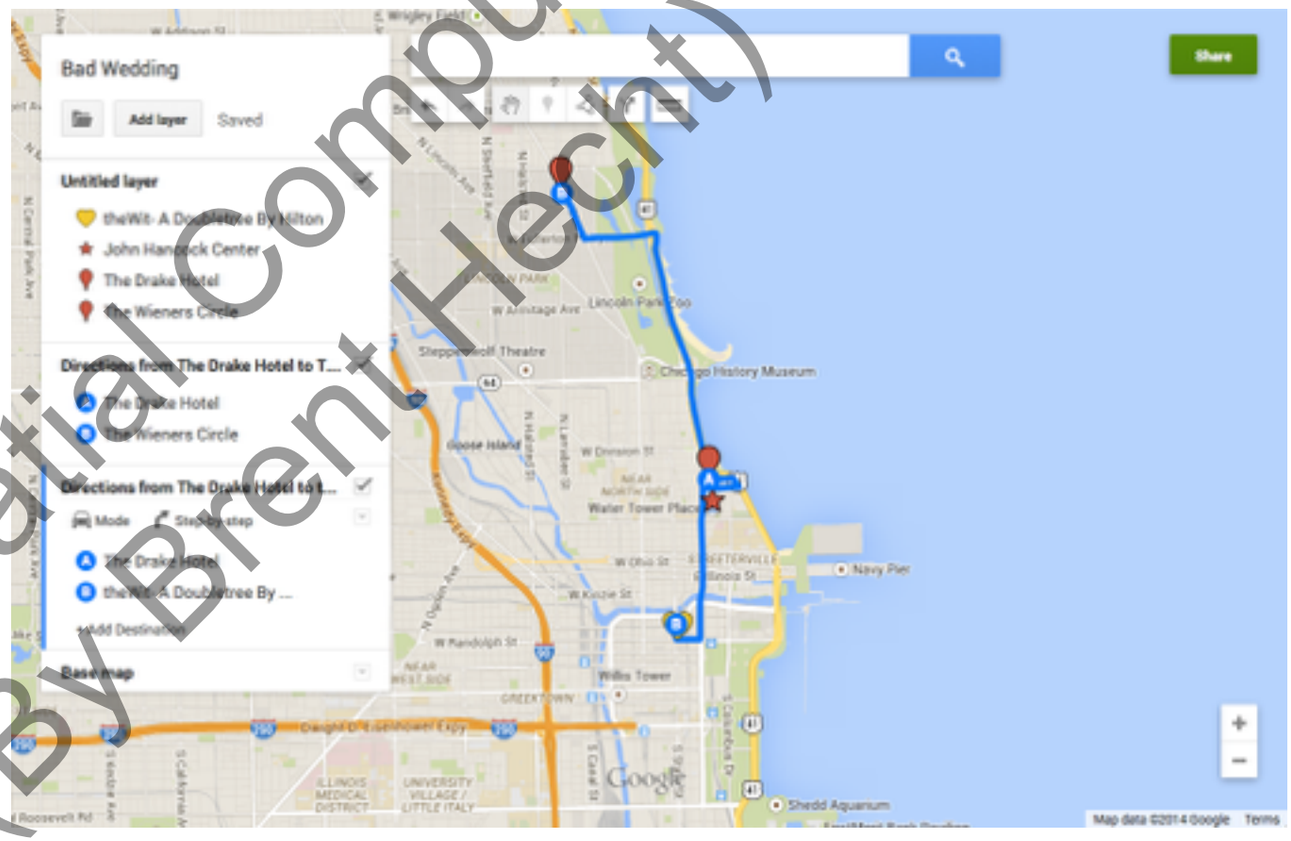

Google Maps

https://www.google.com/maps/@41.8796333,-87.6514746,12z

Google

Traffic, Transit, Bicycling, Terrain, Directions

+Brent

Brunch!

Hotel and Reception

Ceremony!

Earth

Map data ©2014 Google Terms Privacy Report a problem 2 mi

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Spatial Computing – University of Minnesota

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Cartography

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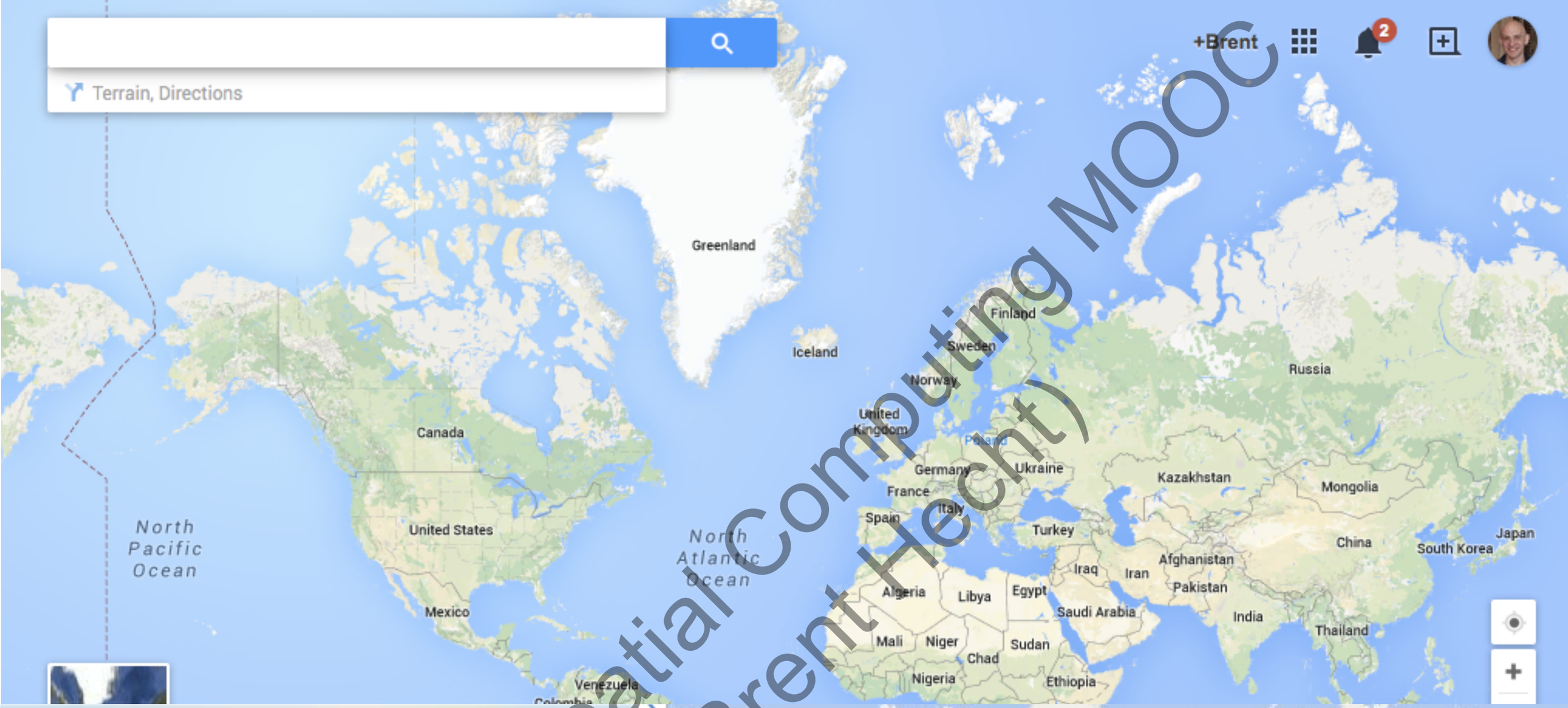
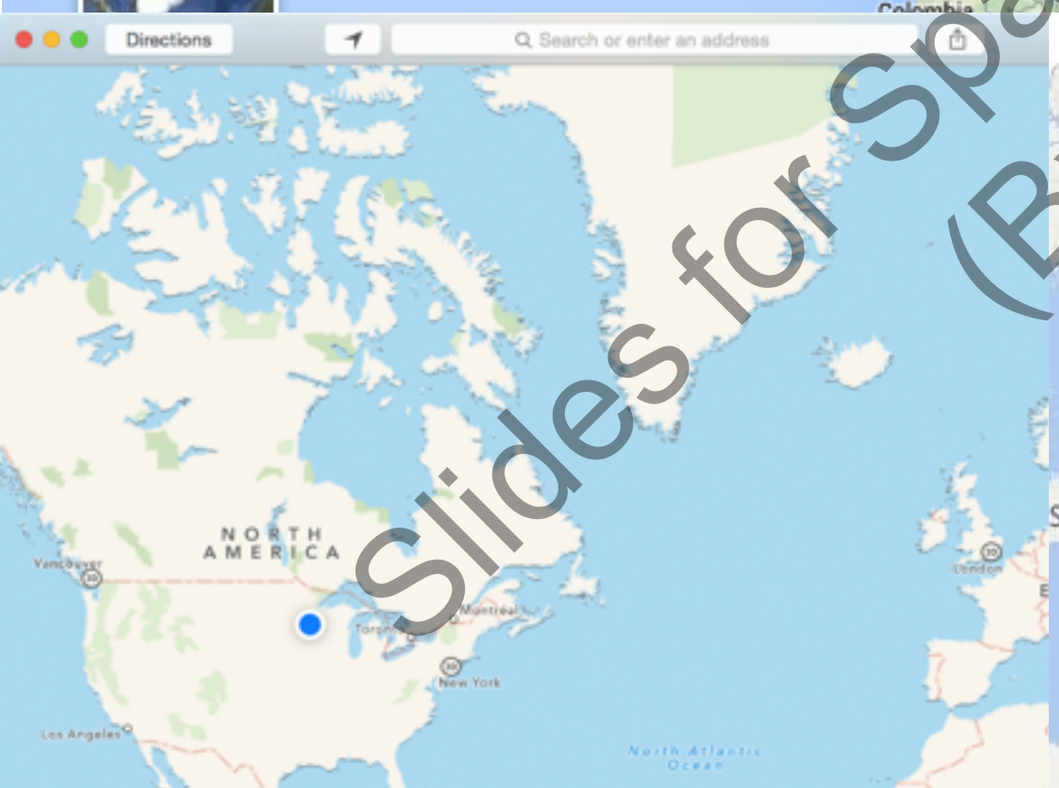
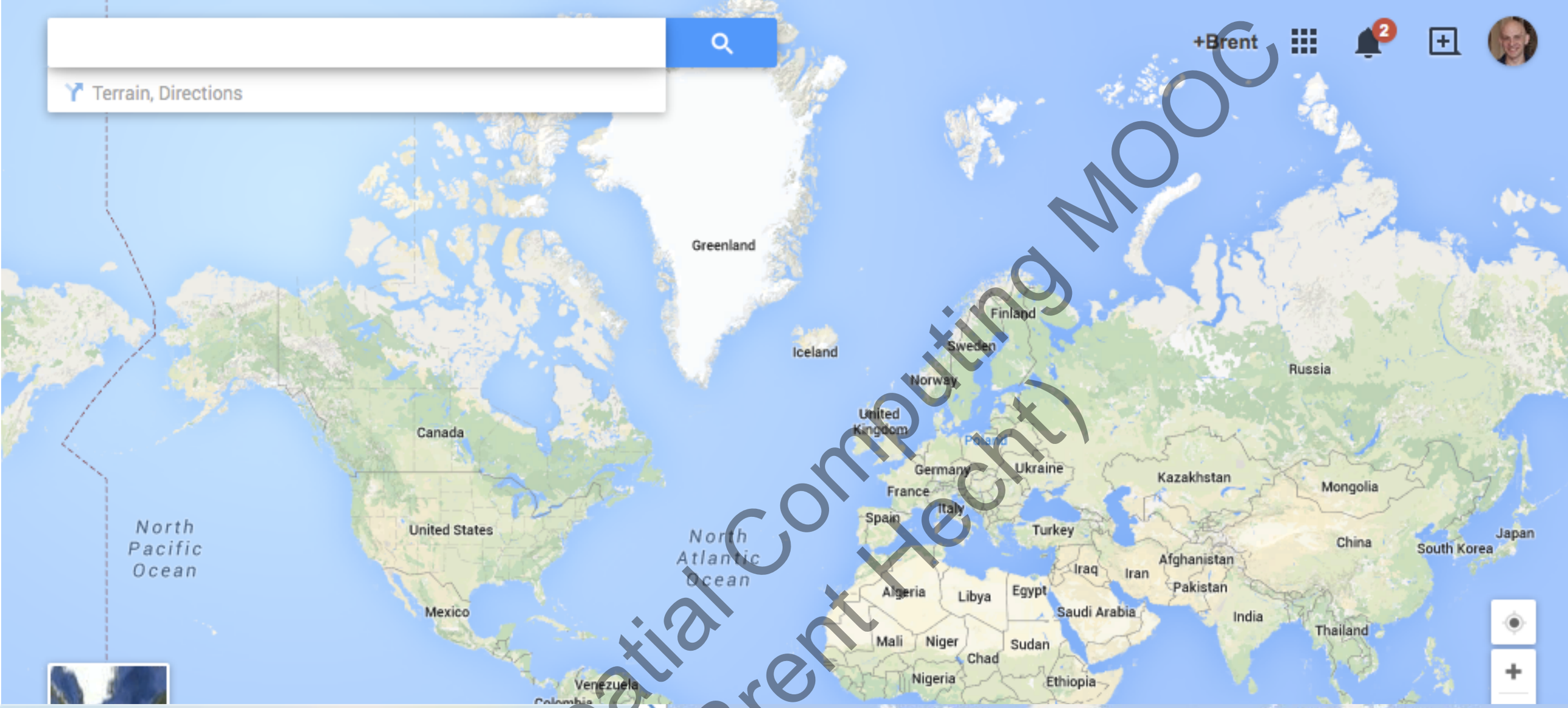
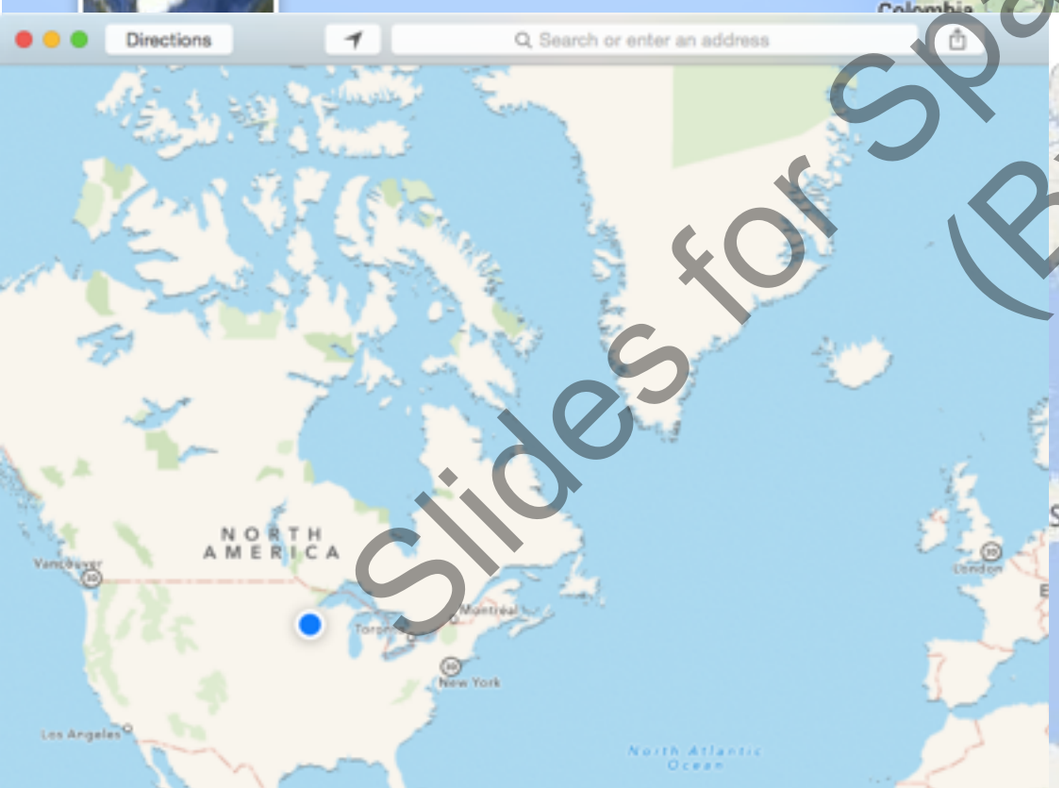
Limitations of popular online and mobile **reference maps**:

1. Inaccurate representations (e.g. Mercator projection)









Arthur H. Robinson

http://www.geography.wisc.edu/history/faculty.php

"Take an orange and draw something on it -- say, a human face. Now carefully remove the peel, trying to keep it in one piece, and flatten it against your kitchen table. You'll see that in making a two-dimensional object out of a round one, something has to give. Either the face gets distorted and looks all 'mushed out,' or in flattening the peel, it breaks into segments, dividing the face as well into several parts."

"Arthur H. Robinson, 89; Cartographer Hailed for Map's Elliptical Design". Myrna Oliver, Los Angeles Times*. Nov. 17, 2004.*

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The Free Encyclopedia

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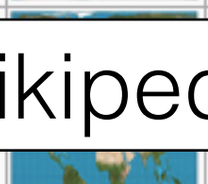
List of map projections

From Wikipedia, the free encyclopedia

This list/table provides an overview of the most significant map projections, including those listed on Wikipedia. It is sortable by the main fields. Inclusion in the table is subjective, as there is no definitive **list of map projections**.

Table of projections [edit]

Projection	Images	Type	Properties	Creator	Year	Notes
Equirectangular = equidistant cylindrical = rectangular = la carte parallélogrammatique		Cylindrical	Equidistant	Marinus of Tyre	120 (c.)	Simplest geometry; distances along meridians are conserved. Plate carrée: special case having the equator as the standard parallel.
Mercator = Wright		Cylindrical	Conformal	Gerardus Mercator	1569	Lines of constant bearing (rhumb lines) are straight, aiding navigation. Areas inflate with latitude, becoming so extreme that the map cannot show the poles.
Gauss–Krüger = Gauss conformal = (Elliposidal) Transverse Mercator		Cylindrical	Conformal	Carl Friedrich Gauss Johann Heinrich Louis Krüger	1822	This transverse, ellipsoidal form of the Mercator is finite, unlike the equatorial Mercator. Forms the basis of the Universal Transverse Mercator system.
Gall stereographic similar to Braun		Cylindrical	Compromise	James Gall	1885	Intended to resemble the Mercator while also displaying the poles. Standard parallels at 45°N/S. Braun is horizontally stretched version with scale correct at equator.
Miller = Miller cylindrical		Cylindrical	Compromise	Osborn Maitland Miller	1942	Intended to resemble the Mercator while also displaying the poles.
Lambert cylindrical equal-area		Cylindrical	Equal-area	Johann Heinrich Lambert	1772	Standard parallel at the equator. Aspect ratio of π (3.14). Base projection of the cylindrical equal-area family.
Behrmann		Cylindrical	Equal-area	Walter Behrmann	1910	Horizontally compressed version of the Lambert equal-area. Has standard parallels at 30°N/S and an aspect ratio of 2.36.
= Gall orthographic = Peters		Cylindrical	Equal-area	James Gall (Arno Peters)	1855	Horizontally compressed version of the Lambert equal-area. Standard parallels at 45°N/S. Aspect ratio of ~1.6. Similar is Balthasart projection with standard parallels at 50°N/S.

…qual surface (= Craster rectangular)

List of map projections

From Wikipedia, the free encyclopedia

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…qual surface (= Craster rectangular)

(Web) Mercator

http://en.wikipedia.org/wiki/List_of_map_projections

Google Maps

https://www.google.com/maps/@48.6498144,-93.9299259,2z

Google

Terrain, Directions

+Brent

Greenland

Iceland

Finland

Sweden

Norway

Russia

United Kingdom

Poland

Germany

Ukraine

Kazakhstan

France

Italy

Spain

Turkey

Afghanistan

Iraq

Iran

Pakistan

India

Algeria

Libya

Egypt

Saudi Arabia

Mali

Niger

Chad

Sudan

Nigeria

Ethiopia

Kenya

DR Congo

Tanzania

Angola

Namibia

Botswana

Madagascar

South Africa

Mongolia

China

South Korea

Japan

Thailand

Indonesia

Papua New Guinea

Australia

New Zealand

Canada

United States

Mexico

Venezuela

Colombia

Peru

Brazil

Bolivia

Chile

Argentina

North Pacific Ocean

North Atlantic Ocean

South Pacific Ocean

South Atlantic Ocean

Earth

Google

Map data ©2014 Terms Privacy 1000 mi

Google Maps

https://www.google.com/maps/@48.6498144,-93.9299259,2z

Google

Terrain, Directions

+Brent

Greenland

Russia

Canada

United States

Mexico

Mongolia

China

South Korea

Japan

Thailand

Indonesia

Papua New Guinea

Australia

New Zealand

North Pacific Ocean

South Pacific Ocean

Venezuela

Colombia

Peru

Brazil

Bolivia

Chile

Argentina

Iceland

Norway

Sweden

Finland

United Kingdom

France

Italy

Kazakhstan

Afghanistan

Iraq

Iran

Pakistan

India

Algeria

Libya

Egypt

Saudi Arabia

Mali

Niger

Chad

Sudan

Nigeria

Ethiopia

Kenya

DR Congo

Tanzania

Angola

Namibia

Botswana

Madagascar

South Africa

North Atlantic Ocean

South Atlantic Ocean

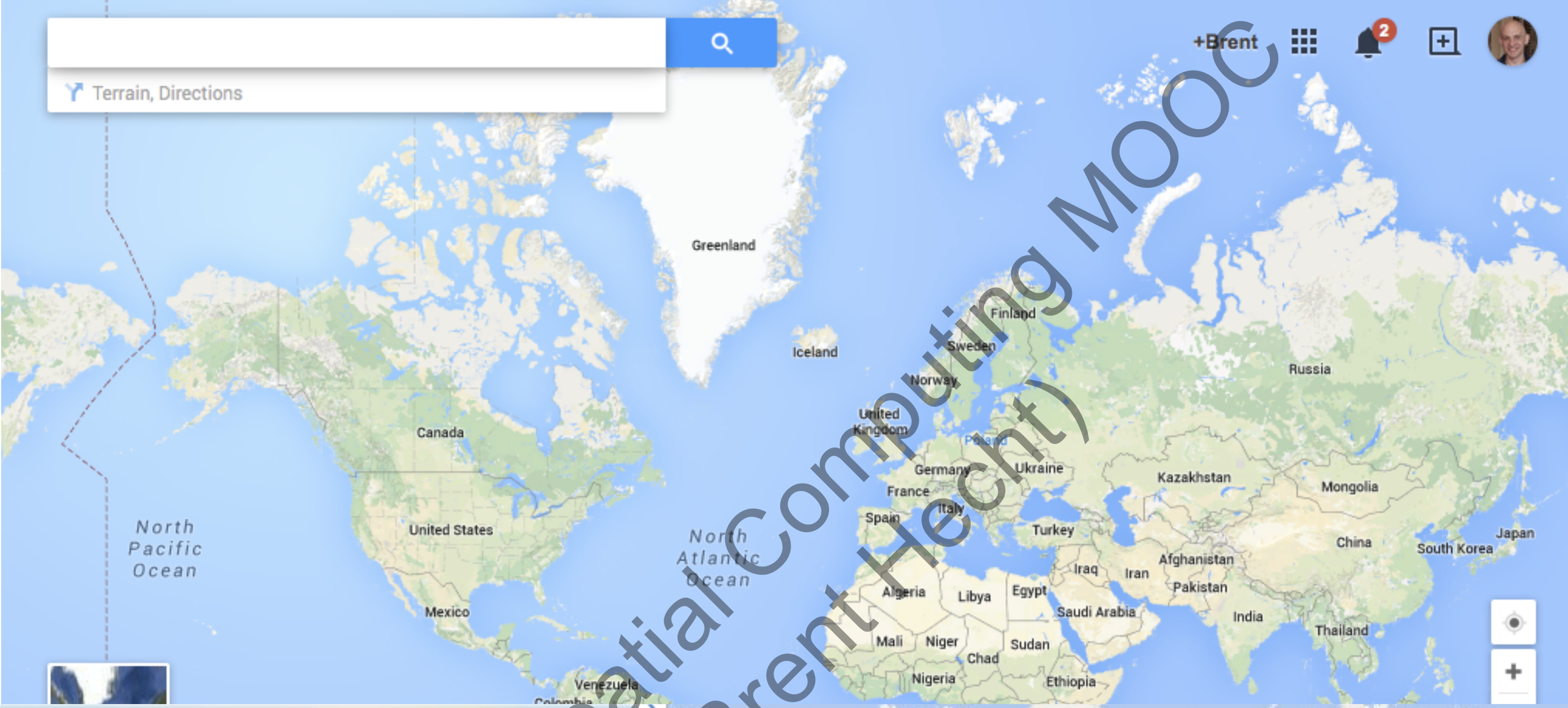
Earth

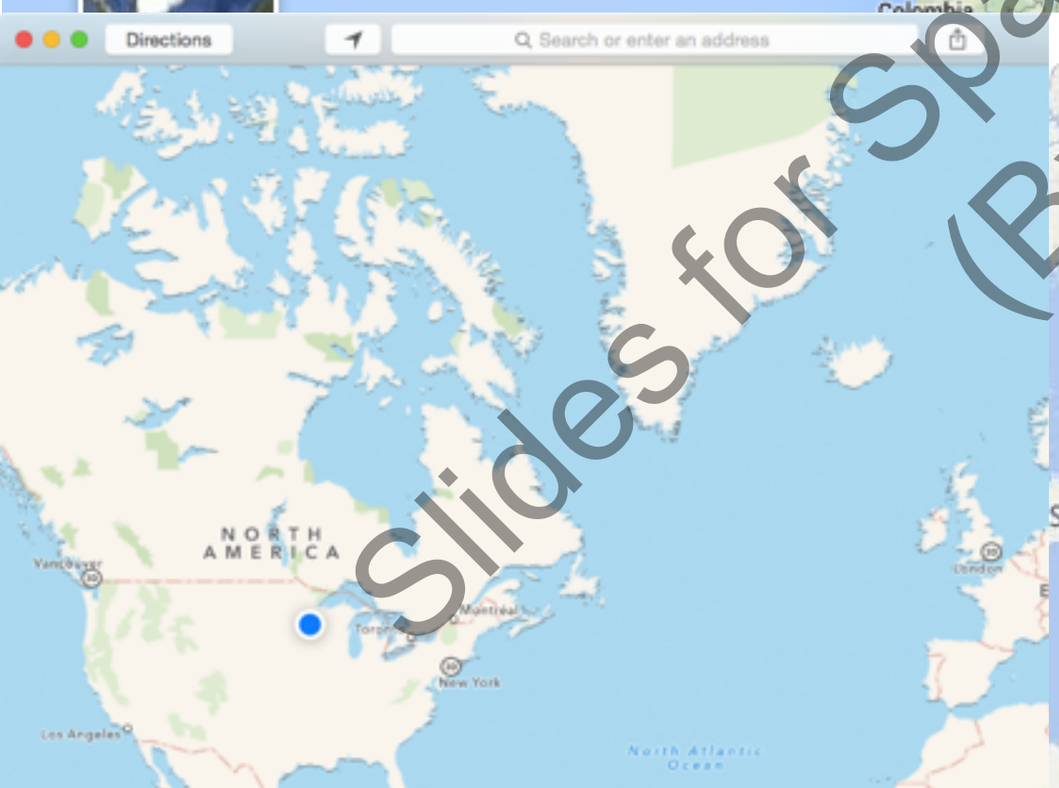
Google

Map data ©2014 Terms Privacy 1000 mi

Greenland
(2.17 million sq. km)

Mexico
(1.94 million sq. km)





“Unprojected” Projection

(Don’t use this except for exploratory data analysis!)

5.26 deg²

area

3.2 deg

linear distance

Google Earth

W150°
W170°
Antimeridian
E170°
W130°
W110°
E150°
W90°
E130°
W70°
N85°
E110°
W50°
E90°
W30°
E70°
W10°
Prime Meridian
Arctic Circle
E50°
N45°
N35°
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Image IBCAO
Image U.S. Geological Survey
N15°
Eq 5 for

Google earth

Tour Guide

lat 81.158043° lon 6.886226° eye alt 6834.43 mi

5.26 deg²

linear area

3.2 deg

linear distance

Cartography

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Limitations of popular online and mobile **reference maps**:

1. Inaccurate representations (e.g. Mercator projection)


METRO
Green Line
Metro Transit
East Bank
METRO Green Line
Target Field
Warehouse District/Hennepin Ave.
Nicollet Mall
Government Plaza
Downtown East
West Bank
You are here
East Bank
Stadium Village
Prospect Park
Westgate
Raymond Avenue
Fairview Avenue
Snelling Avenue
Hamline Avenue
Lexington Parkway
Victoria Street
Dale Street
Central
Union Depot
Departure Times
To downtown Minneapolis
To downtown St. Paul
How to ride
Local Bus & METRO Fares
Transit Information
For your safety
No Smoking
East Bank Station
Welcome to East Bank Station
Paper Map
(1) larger display sizes
(2) zero power requirement
Smartphone Map
Slides for Spatial Computing MOOC
(By Brent Hecht)

World's oldest map: Spanish cave has landscape from 14,000 years ago

Archaeologists have discovered what they believe is man's earliest map, dating from almost 14,000 years ago.

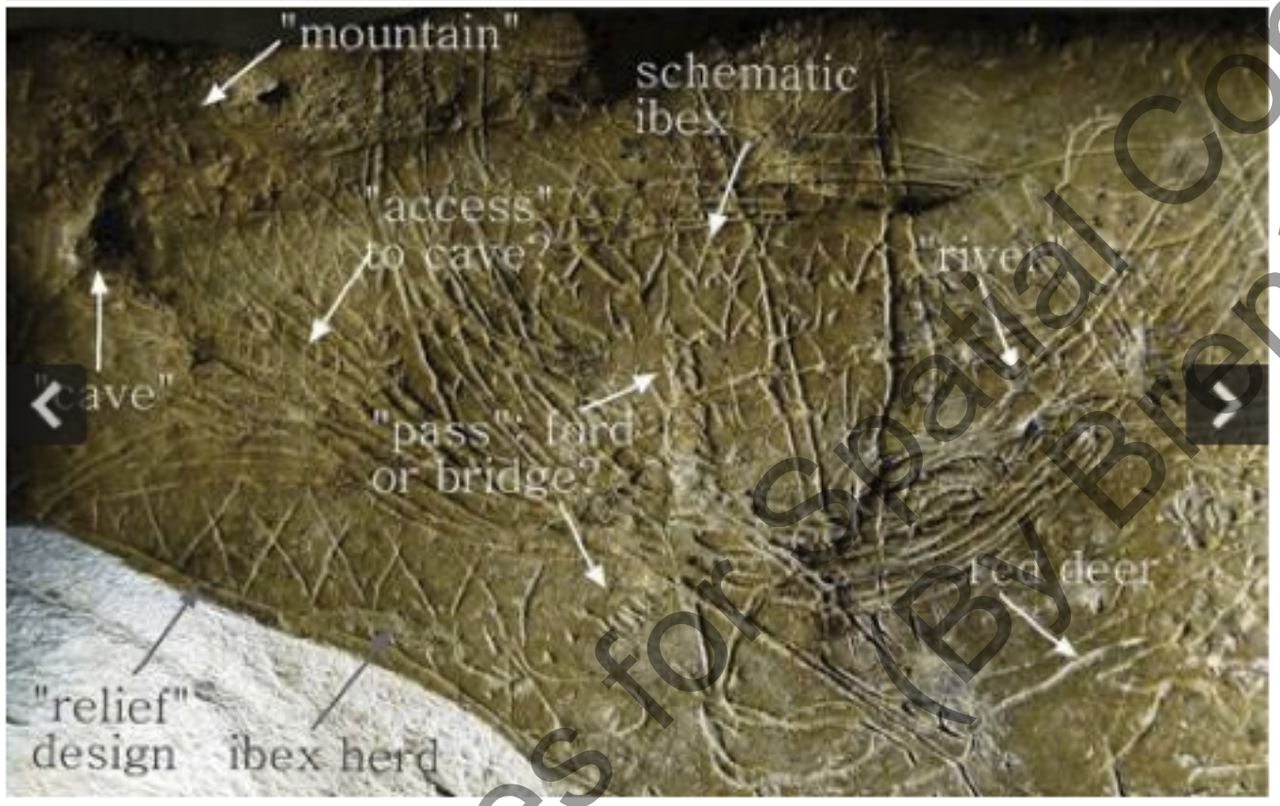

Image 1 of 2
Archaeologists have discovered what they believe is man's earliest map, dating from almost 14,000 years ago Photo: EPA

By Fiona Govan in Madrid
7:30AM BST 06 Aug 2009

A stone tablet found in a cave in Abauntz in the Navarra region of northern Spain is believed to contain the earliest known representation of

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1. Inaccurate representations (e.g. Mercator projection)
2. Paper maps are still better in a few ways

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www.google.com/permissions/geoguidelines.html#maps-print

Google

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http://www.google.com/permissions/geoguidelines.html#maps-print

d to know?

How does the broadcast license process work?

javascript: void 0

Hotels.com - hotels in Queb…

www.hotels.com/search/searchmap.html?children[0]=0&roomInfoList[0].numberOfAdu

Google

Show List

Quebec, Canada

Fri 24 - Sat 25, October 2014 , **1 night** 1 room, 2 adults,

Change search

Search map for Location, landmark, station etc... Go

Name contains

Hotel name…

Average Nightly Rate

$0 to $500+

Star rating

★★★★★

★★★★

★★★

★★

★

Guest rating

0 to 5

Neighborhood

- Old Quebec
- Lower Town
- Upper Town
- Sainte-Foy-Sillery
- La Cite-Limoilou

Google Map

Map Satellite

Sainte-Anne-de-Beaupré

Sainte-Brigitte-de-Laval

Saint-Gabriel-de-Valcartier

Île d'Orléans

Shannon

Wendake

Boischatel

Beaumont

Levis

Pont-Rouge

Neuville

Fleuve Saint-Laurent

Cap-Santé

St-Croix

Saint-Apollinaire

Saint-Henri

Saint-Anselme

Google

Map data ©2014 Google 5 km Terms of Use Report a map error

DoorDash Food Delivery | R...

https://www.doordash.com/?force=1

Google

DOORDASH

LOGIN

First delivery free · No minimum order size

Enter your address to find restaurants near you:

Enter street address, city, or zip code

Google Map

There are 139 restaurants near your location

Show Restaurants

Greer Park

Egret Pond

Celia Dr

Moreno Ave

Colonial Ln

Amarillo Ave

Warren Way

Oregon Expy

Marshall Dr

Marion Ave

Webster St

Bryson Ave

Sutter Ave

Ross Rd

Clara Dr

Stelling Dr

Stern Ave

Middlefield Rd

Loma Verde Ave

Louis Rd

Ames Ave

Stockton Pl

Morris Dr

Thomas Dr

Kenneth Dr

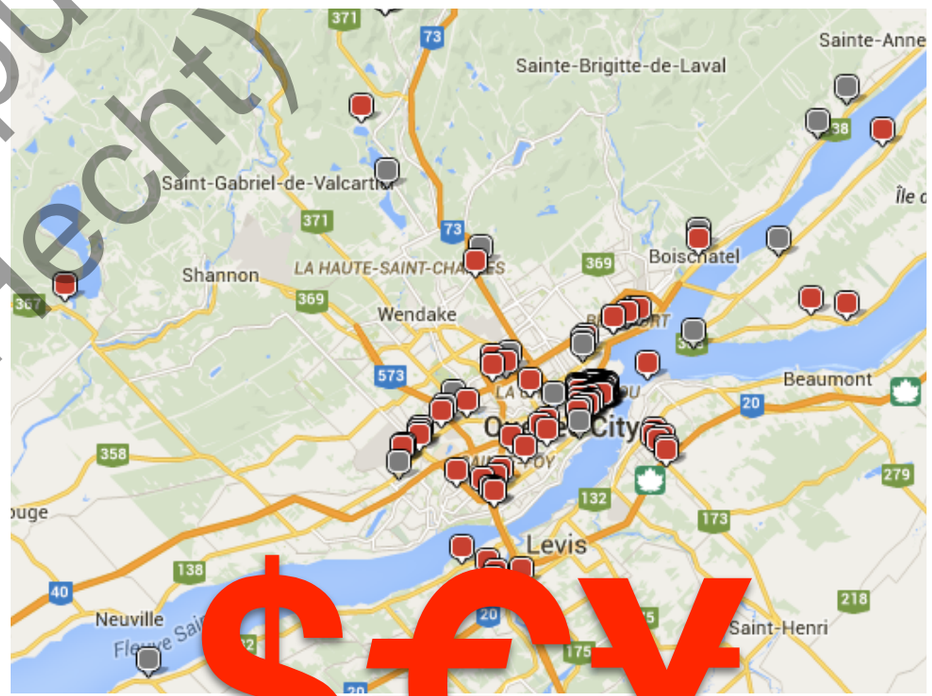
Evergreen Dr

Talisman Dr

101

25,000
map loads

90
consecutive
days



$€¥

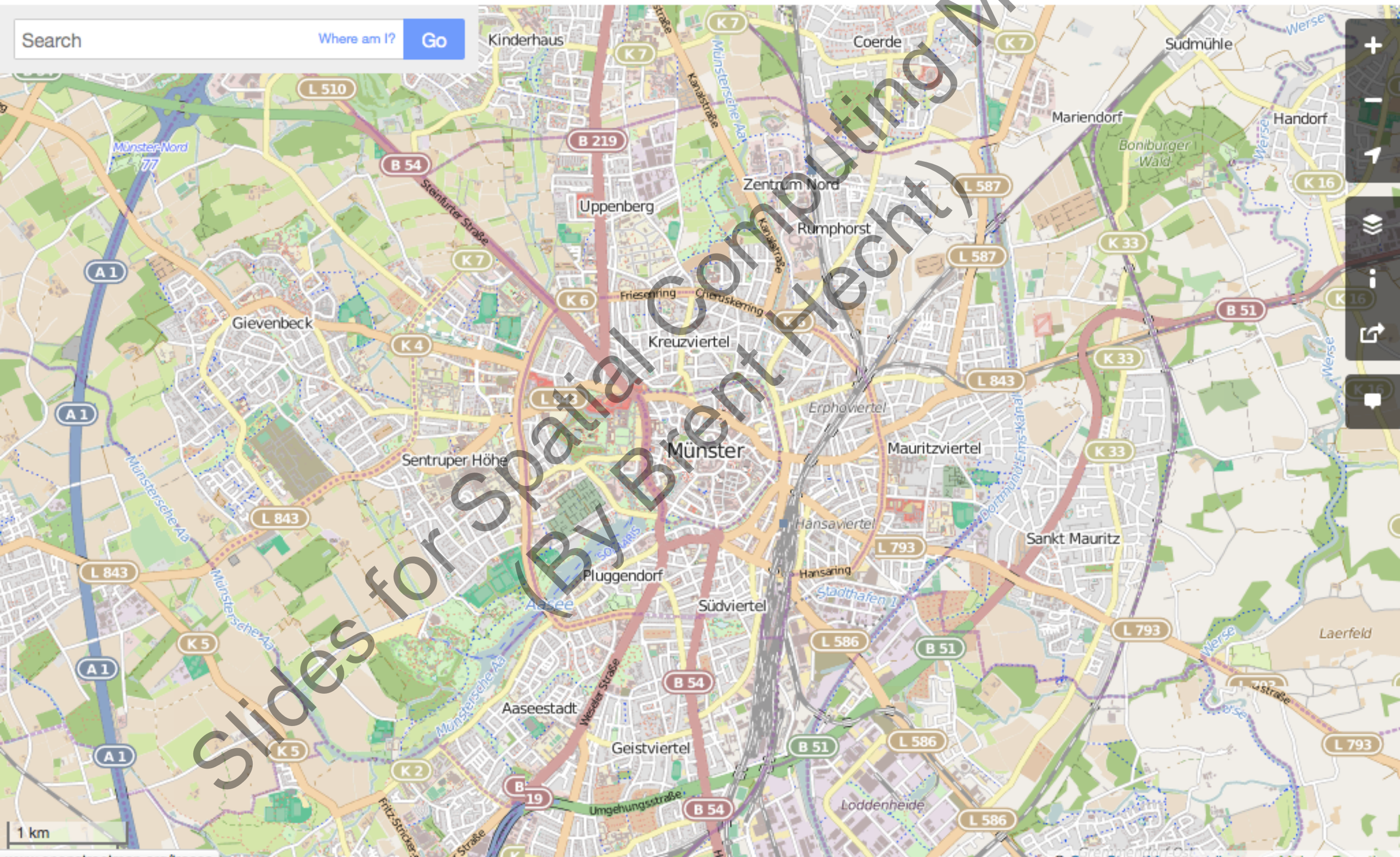
OpenStreetMap

www.openstreetmap.org/#map=13/51.9634/7.6245

Google

OpenStreetMap | Edit | History | Export | GPS Traces | User Diaries | Copyright | Help | About | Log In | Sign Up

Search | Where am I? | Go



www.openstreetmap.org/traces

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www.openstreetmap.org/copyright

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Limitations of popular online and mobile **reference maps**:

1. Inaccurate representations (e.g. Mercator projection)
2. Paper maps are still better in a few ways
3. Terms of use limitations

The Telegraph

Google maps error sparks invasion of Costa Rica by Nicaragua

Nicaragua has used an error on Google's internet maps system to justify an invasion of Costa Rica.

Informing Online and Mobile Map Design with the Collective Wisdom of Cartographers

Johannes Schöning
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Hasselt University – tUL - iMinds
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Brent Hecht
Dept. of Comp. Sci and Engineering
University of Minnesota
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Werner Kuhn
Department of Geography
UC Santa Barbara
kuhn@geog.ucsb.edu

ABSTRACT
Despite the large and growing prominence of online and mobile maps, they have not been broadly and systematically examined with a lens informed by traditional cartography. Using an approach rooted in cartographic theory and a unique dataset of 382 publicly-displayed local maps, we identify the "collective wisdom" of hundreds of cartographers with respect to a number of cartographic design decisions. We compare our findings to the approaches taken in popular online and mobile map platforms and develop suggestions for incorporating the collective wisdom of cartographers into these systems. Our suggestions include the adoption of *location-aware cartography*, in which cartographic approaches are intelligently varied based on the type of location being viewed. We provide mockup designs of online and mobile maps that implement our suggestions and discuss means by which the surprising gap between online and mobile maps and traditional cartography may be bridged.

Author Keywords
Mobile maps; online maps; cartography; geography; local

in which "mobile matters most" [27]. The latter assertion is supported by recent statistics that suggest that the Google Maps app is the most popular app in the world [8].

The rapid increase in the popularity of online and mobile maps means that cartography now plays a more prominent role in many people's daily lives than ever before. Despite this newfound prominence, however, online and mobile maps have not been systematically examined with a traditional cartographic lens. Indeed, a surprisingly large gap exists between traditional cartography and well-known online and mobile maps [11,36]. For instance, Google Maps has been developed almost exclusively by non-cartographers, although this has been changing recently [24]. Along the same lines, Apple Maps' cartographic approaches have been the subject of heavy criticism by professional mapmakers [4,15].

The high-level goal of this paper is to begin the process of better integrating traditional cartography and modern online/mobile maps. Our approach for doing is so is rooted in cartographic theory and allows us to infer the collective wisdom of cartographers, present in a corpus of maps using

Space Usage Rules

You Can't Smoke Here: Towards Support for Space Usage Rules in Location-aware Technologies

Pavel Samsonov*, Xun Tang[§], Johannes Schöning*, Werner Kuhn[†], Brent Hecht[‡§],

*Hasselt University - tUL - iMinds; [§]Department of Computer Science and Engineering, University of Minnesota, [†]Department of Geography, University of California, Santa Barbara; [‡]GroupLens Research, University of Minnesota

{pavel.samsonov, johannes.schoening}@uhasselt.be, {bhecht,xuntang}@cs.umn.edu, kuhn@geog.ucsb.edu

ABSTRACT

Recent work has identified the lack of *space usage rule* (SUR) data – e.g. "no smoking", "no campfires" – as an important limitation of online/mobile maps that presents risks to user safety and the environment. In order to address this limitation, a large-scale means of mapping SURs must be developed. In this paper, we introduce and motivate the problem of mapping space usage rules and take the first steps towards identifying solutions. We show how computer vision can be employed to identify SUR indicators in the environment (e.g. "No Smoking" signs) with reasonable accuracy and describe techniques that can assign each rule to the appropriate geographic feature. We also discuss how our methods can be applied to large repositories of spatially-referenced images (e.g. Google Street View) to generate global-scale datasets of SURs.

Figure 1: An example of a "no-sign" showing a *space usage rule* (SUR), specifically "no dogs allowed".

entirely new class of context-aware applications. For instance, it is easy to imagine a space usage rule-based app that tells smokers if it is legal to light a cigarette in their current location and, similarly, an app that tells hunters

ms that
oid "no
ose that
generate vacation recommendations for specific areas that

caused severe environmental and property damage and was a serious hazard to public safety.

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Space Usage Rules

Einführung

Im Jahr 2013 machte ein Besucher eines Nationalparks in Kalifornien ein Lagerfeuer. Dieses Lagerfeuer geriet außer Kontrolle und verursachte auf einer Fläche von über 1000 Quadratkilometern den als „Rim Fire“ bekannt gewordenen Riesenwaldbrand. Dabei galt am Brandherd eine sogenannte *Space Usage Rule* (SUR), die das Anlegen von Lagerfeuern streng verbietet. Diese Information konnte der Besucher, der sich zuvor auf seinem Mobiltelefon über die Parkregeln informiert hatte, aber digital nicht auffinden.

Space Usage Rules sind dabei nicht auf das Verbot von Lagerfeuern beschränkt, sondern begegnen uns tagtäglich. Regeln wie zum Beispiel „Rauchen verboten“, „Angeln verboten“ oder „Schwimmen verboten“ dienen dabei der öffentlichen Gesundheit und Sicherheit, dem Umweltschutz oder der Einhaltung von Gesetzen. Informationsschilder weisen daher die Geltungsbereiche von ortsbezogenen Regeln aus. elektro-

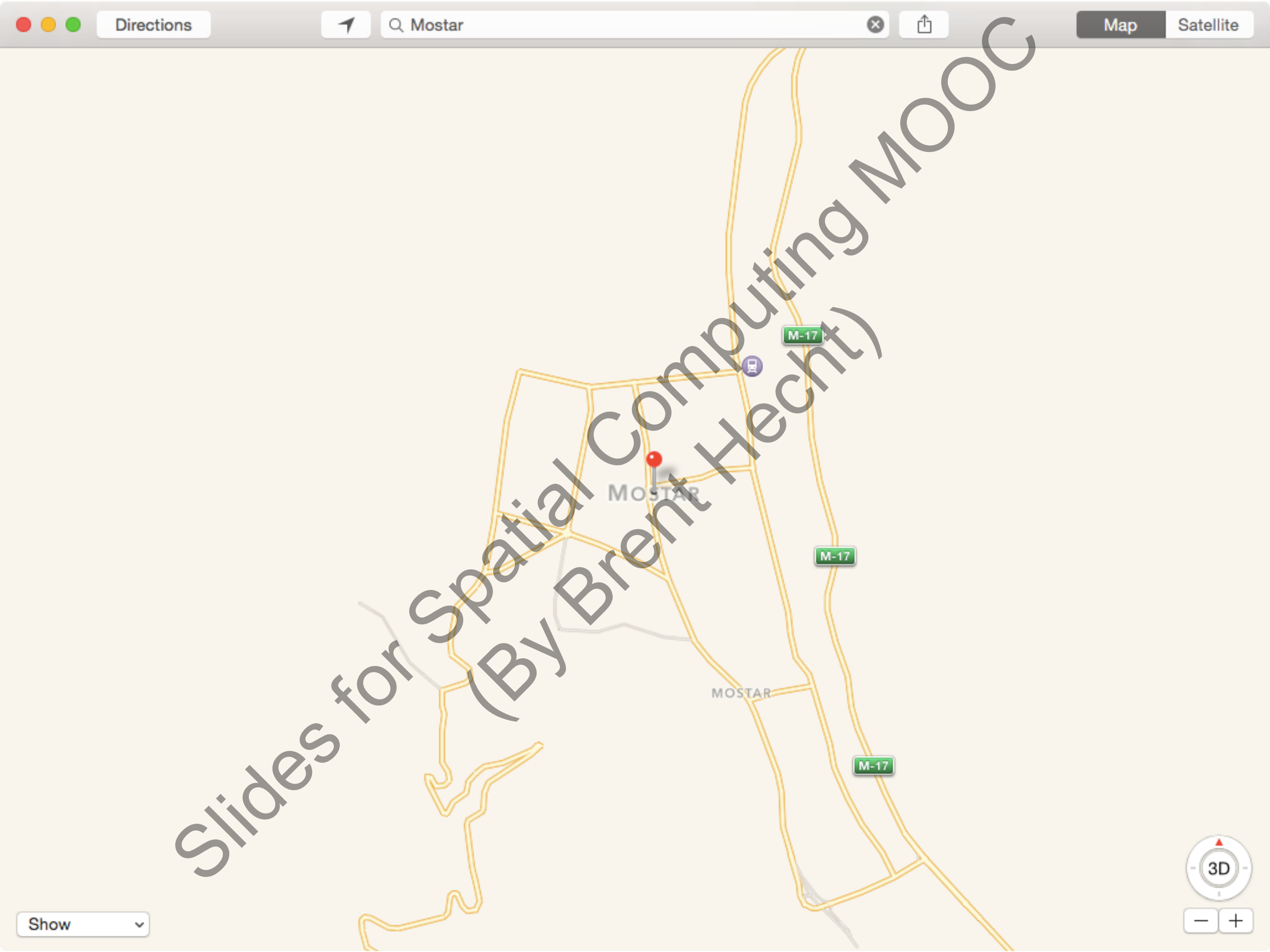
http://informaticup.gi.de/startseite/informaticup-2015.html

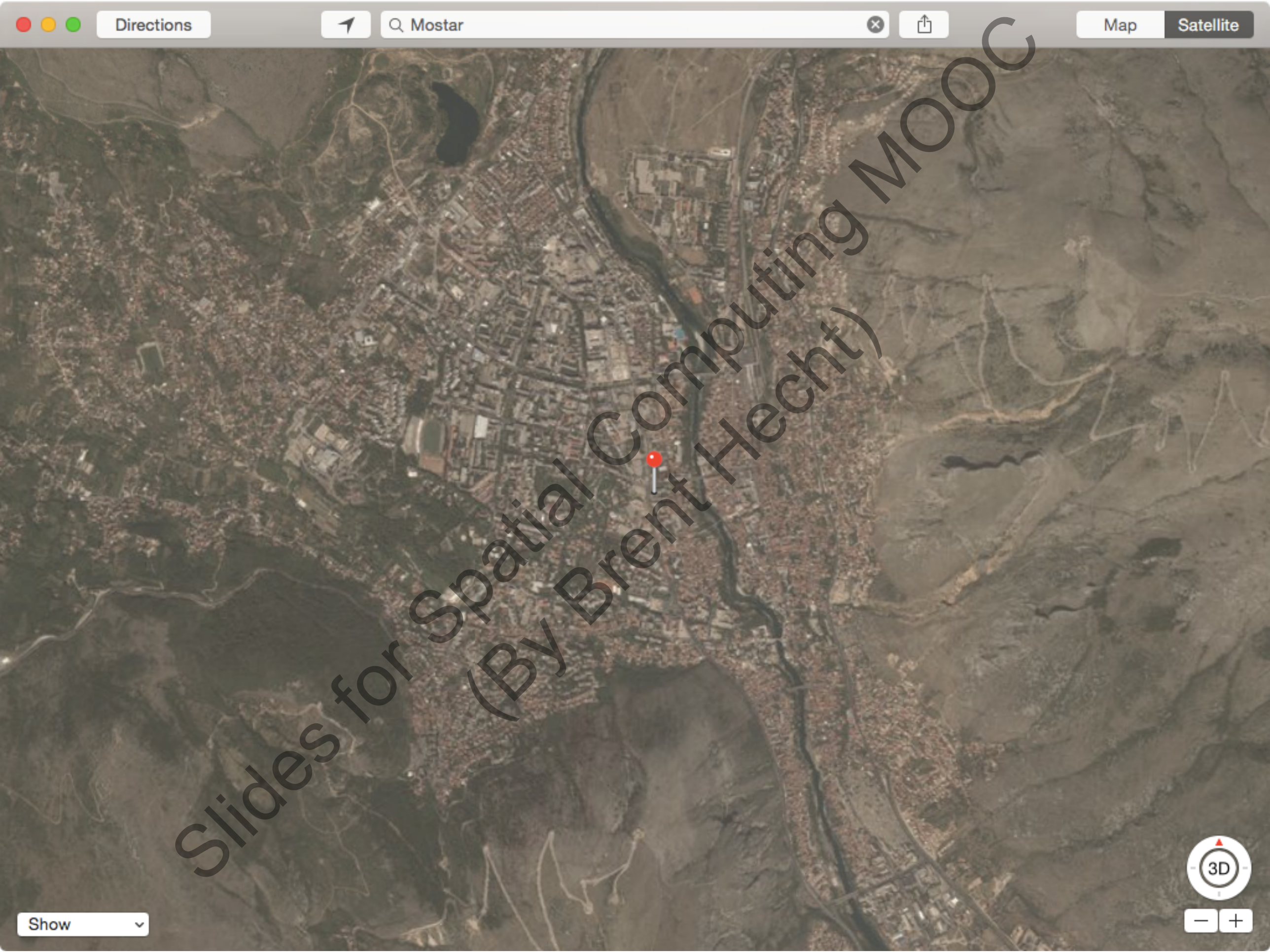
Cartography

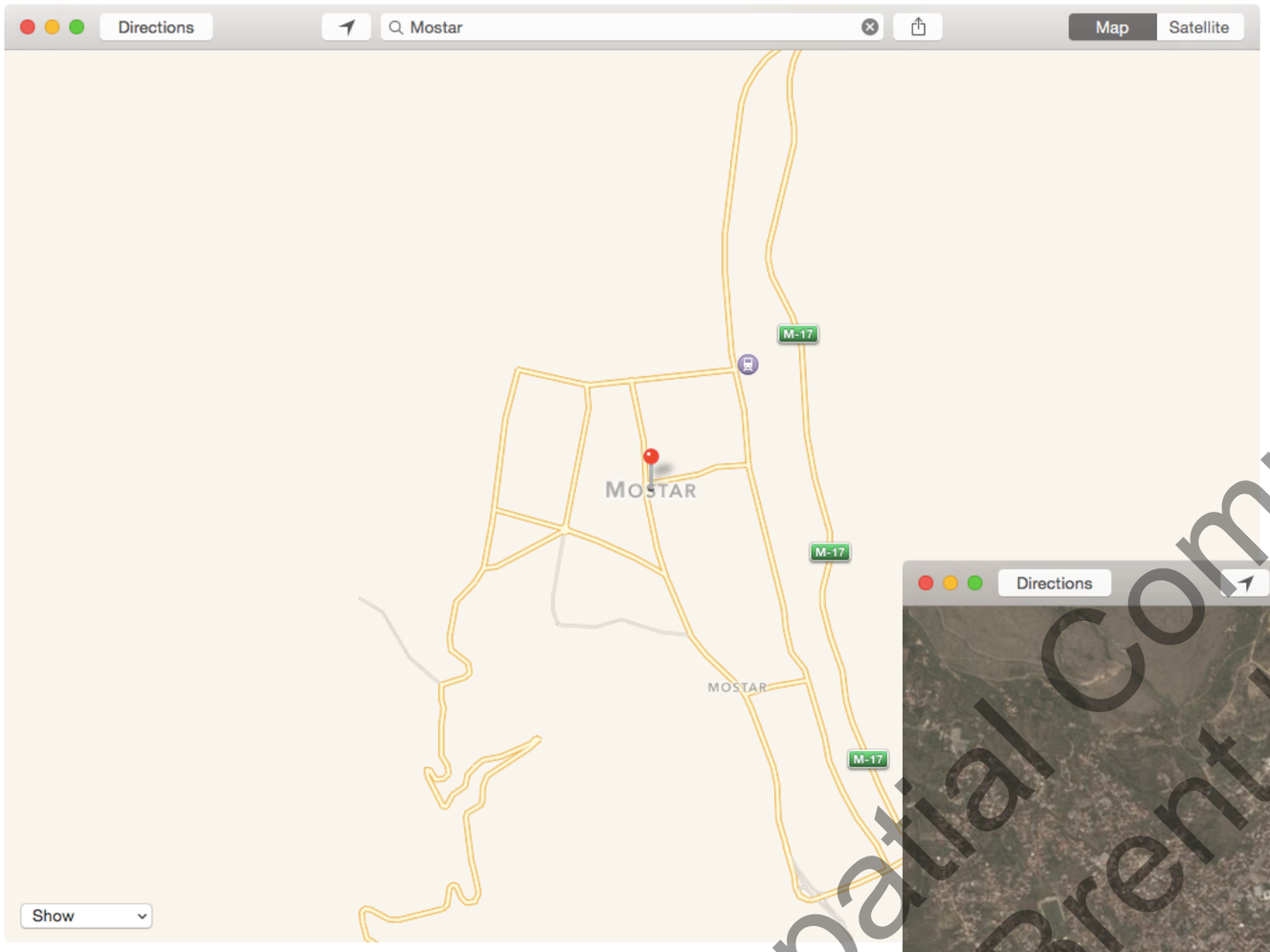
Spatial Computing – University of Minnesota

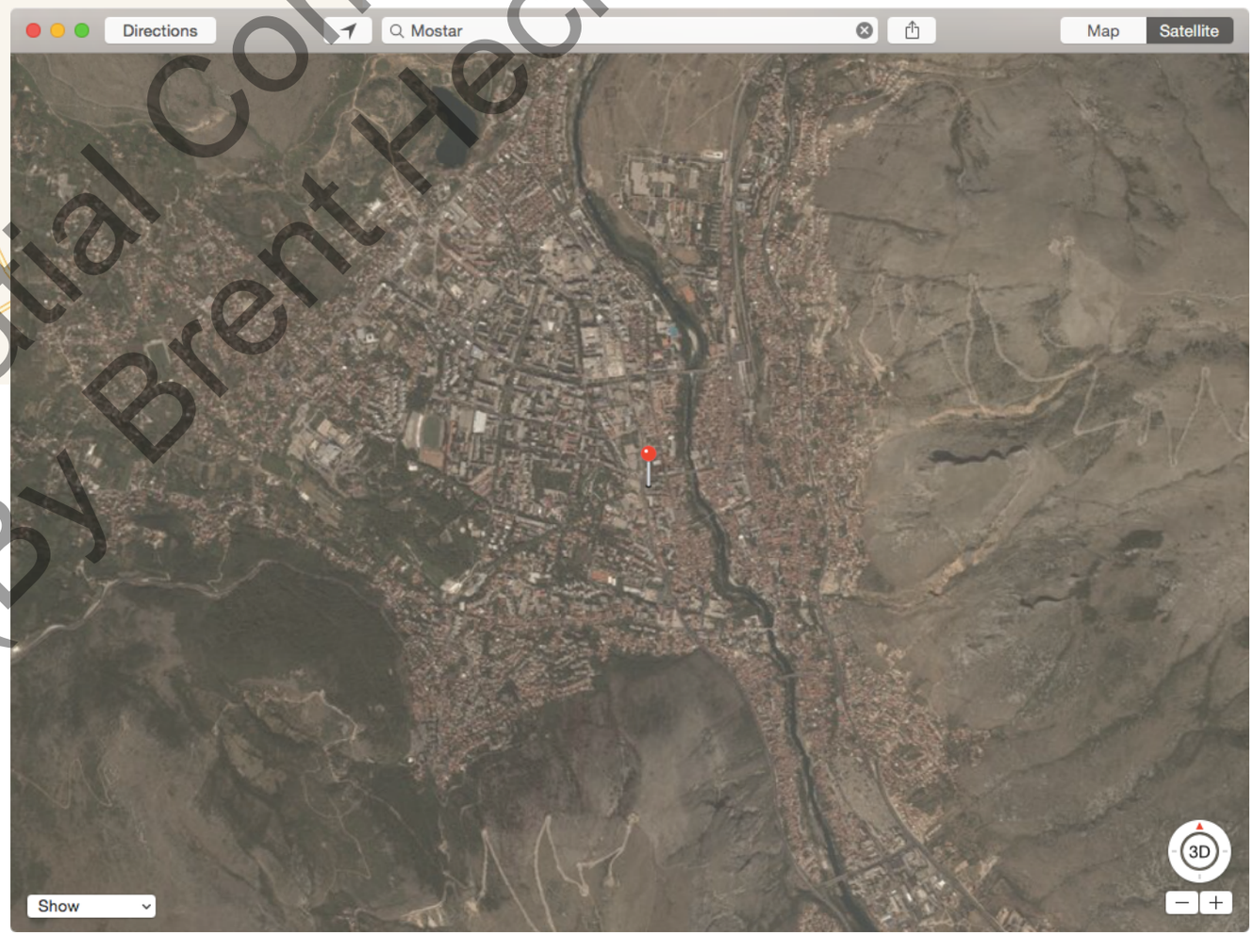
Limitations of popular online and mobile **reference maps**:

1. Inaccurate representations (e.g. Mercator projection)
2. Paper maps are still better in a few ways
3. Terms of use limitations
4. Cartographic hegemony









Directions

Santa Barbara, CA

Map | Satellite

Santa Barbara, CA
Santa Barbara, CA, United States

Show

3D

Cartography

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Limitations of popular online and mobile **reference maps**:

1. Inaccurate representations (e.g. Mercator projection)
2. Paper maps are still better in a few ways
3. Terms of use limitations
4. Cartographic hegemony

Google Maps

https://www.google.com/maps/@44.9725945,-93.2323068,16z

Google

Traffic, Bicycling, Terrain, Directions

+Brent

2

University Ave SE

Pillsbury Dr SE

Church St SE

Pleasant St SE

SE Oak St

SE 23rd Ave

TCF Bank Stadium

McNamara Alumni Center

Scholars Walk

Beacon St SE

The Commons

University of Minnesota

122

SE Washington Ave

Malcolm Moos Health Sciences Tower

Harvard St

Weisman Art Museum

Coffman Memorial Union Bldg

Delaware St SE

Ontario St SE

SE Huron Blvd

25th Ave SE

Mississippi River

East River Pkwy

University of Minnesota Medical Center

Essex St SE

W River Pkwy

S 4th St

East River Flats Park

Fulton St SE

University Commons

Erie St SE

Softball Fields

22nd Ave S

21st Ave S

23rd Ave S

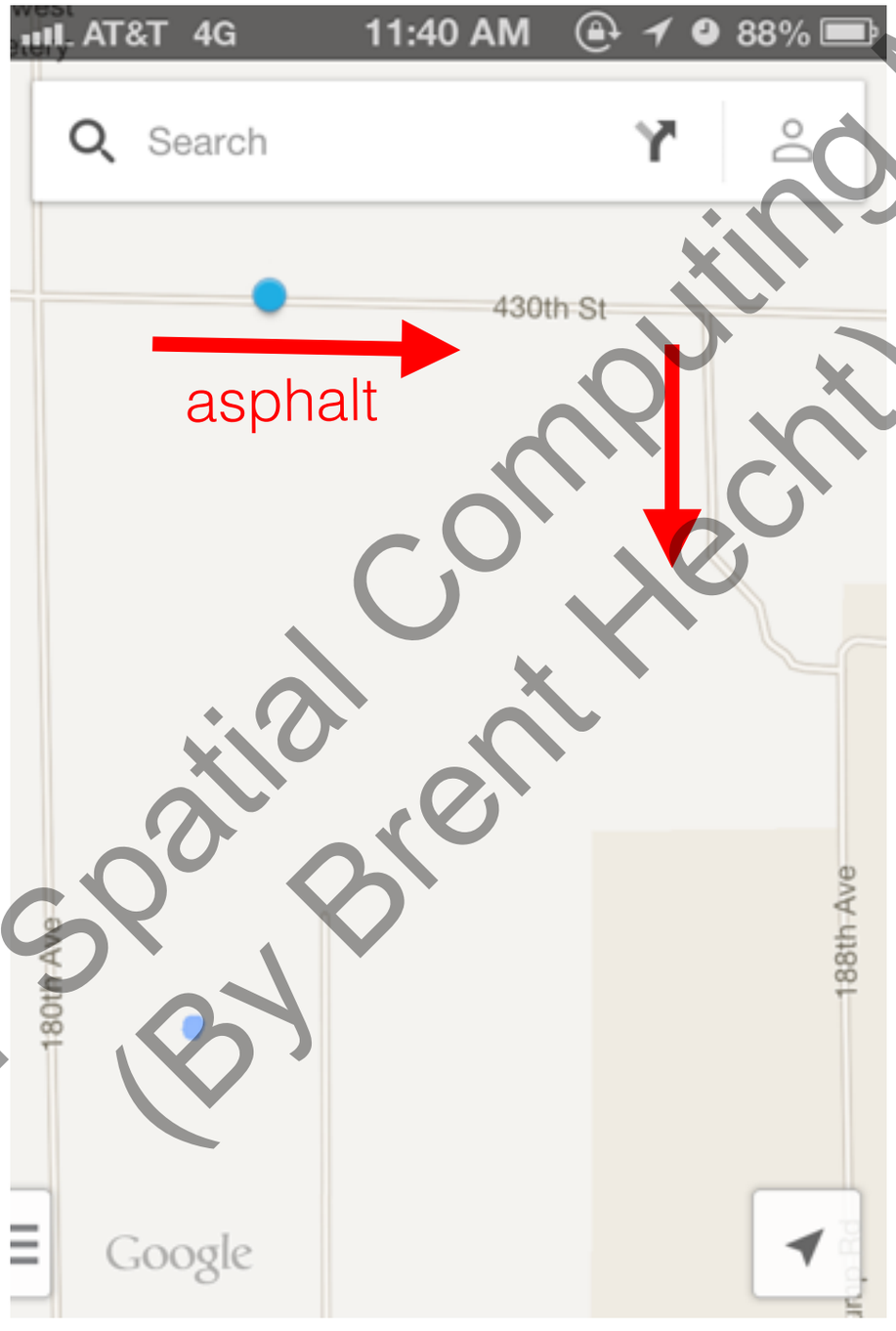
S 6th St

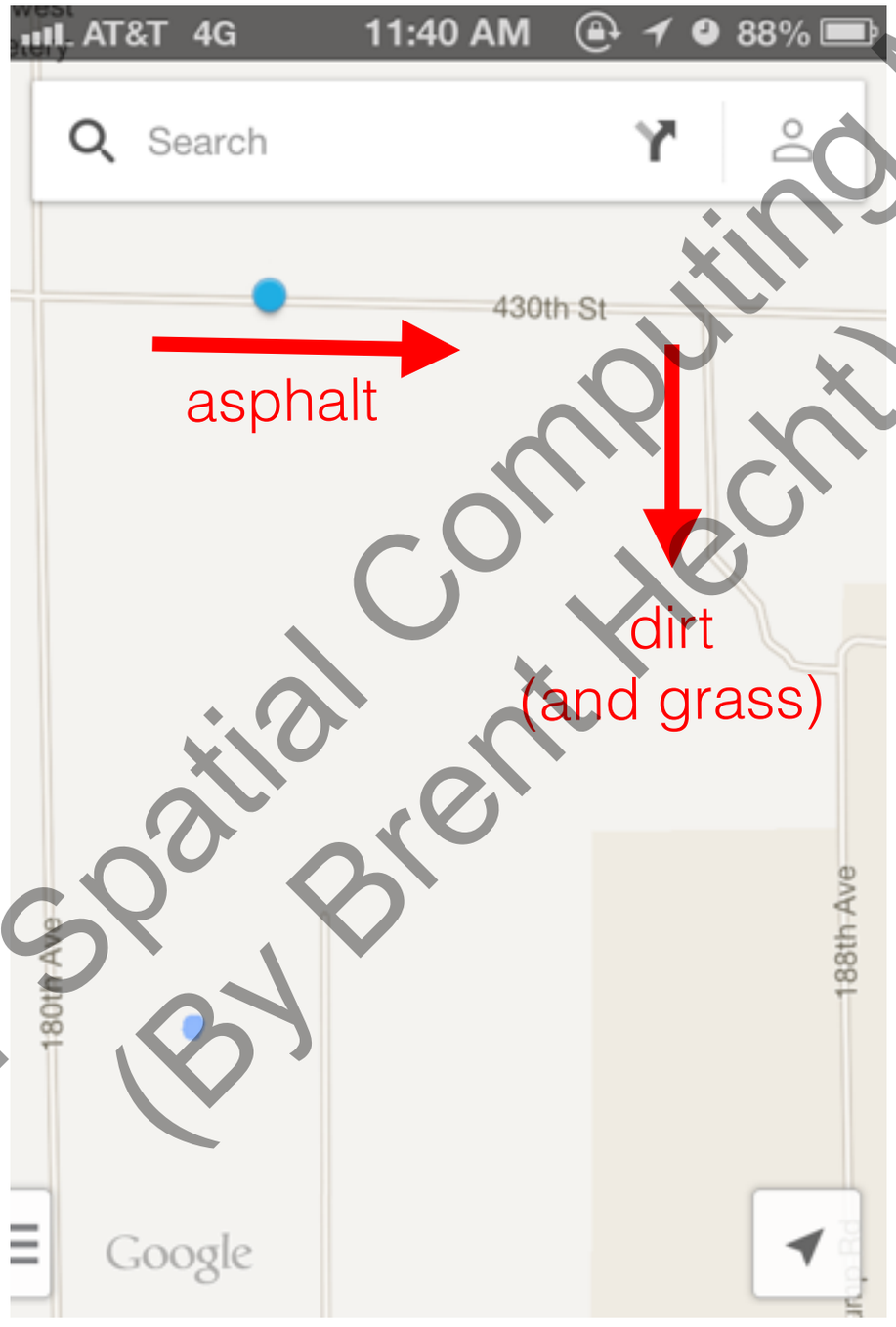
West Bank University

Earth

Google

Map data ©2014 Google Terms Privacy Report a problem 500 ft





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Google

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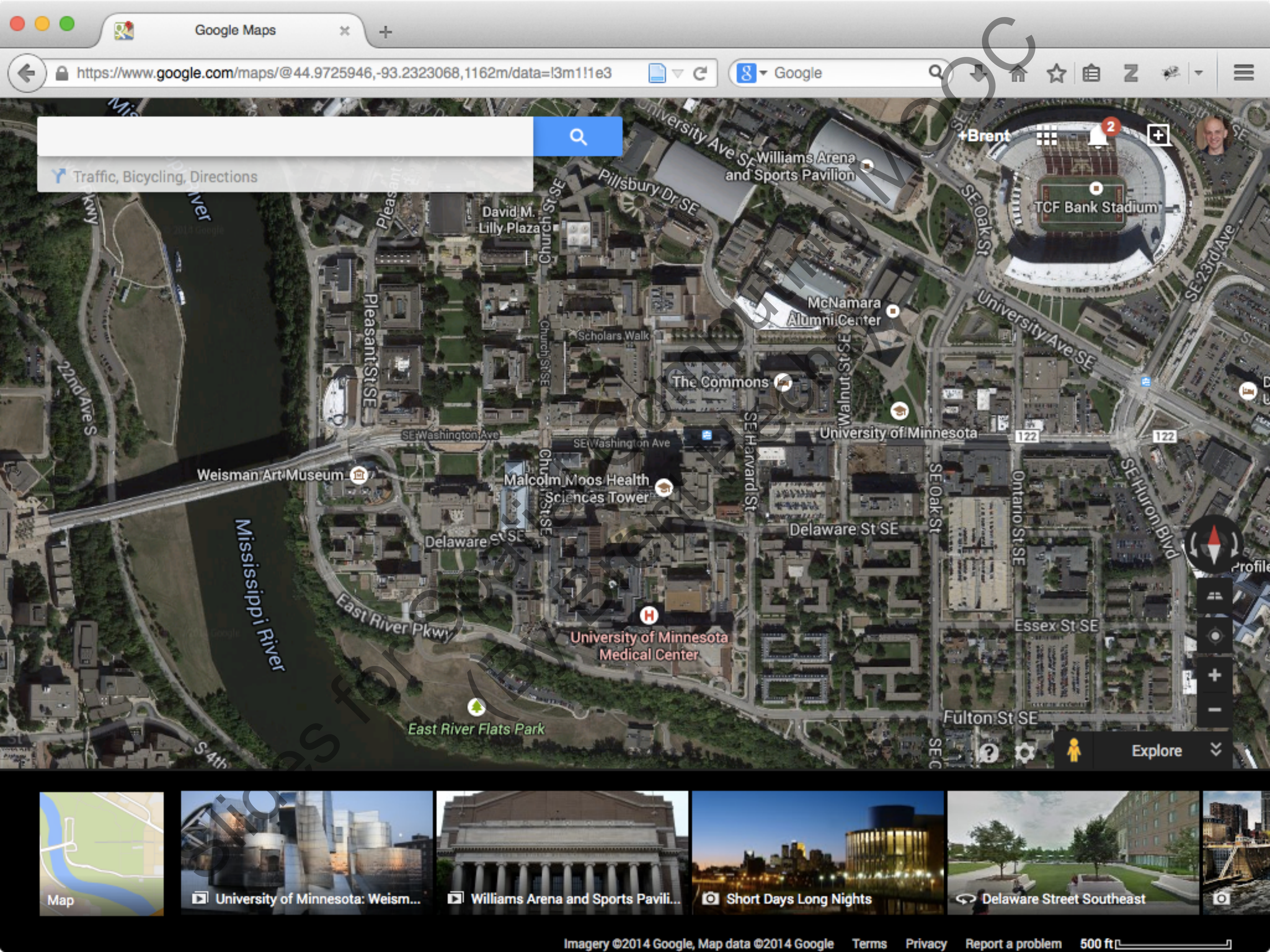
Google Maps
https://www.google.com/maps/@44.9725946,-93.2323068,1162m/data=!3m1!1e3
Google
Traffic, Bicycling, Directions
+Brent
Williams Arena and Sports Pavilion
TCF Bank Stadium
University Ave SE
Pillsbury Dr SE
David M. Lilly Plaza
Church St SE
SE Oak St
McNamara Alumni Center
Scholars Walk
The Commons
Walnut St SE
Pleasant St SE
22nd Ave S
University of Minnesota
SE Washington Ave
Weisman Art Museum
Malcolm Moos Health Sciences Tower
SE Harvard St
Delaware St SE
Ontario St SE
SE Huron Blvd
SE 23rd Ave
Mississippi River
East River Pkwy
University of Minnesota Medical Center
Essex St SE
Fulton St SE
East River Flats Park
Explore
Map
University of Minnesota: Weism...
Williams Arena and Sports Pavili...
Short Days Long Nights
Delaware Street Southeast
Imagery ©2014 Google, Map data ©2014 Google
Terms
Privacy
Report a problem
500 ft

Google Maps | Untitled map

https://www.google.com/maps/d/u/0/edit?mid=zItiMzPdjRfg.kViCJIgCOOAQ

+Brent Search Images Maps Play YouTube News Gmail More

Untitled map

Add layer | Saved

Untitled layer

Import

Add places to this layer by drawing or importing data. Learn more

Base map

Share

DINKYTOWN

Varsity Theater

Gibson-Nagurski...

Biomedical Discovery District

Mariucci Arena

TCF Bank Stadium

McNamara Alumni Center

University of Minnesota

University of Minnesota Medical Center

Fulton St SE

PROSPECT PARK

Yale Ave SE

Franklin Ave SE

Map data ©2014 Google Terms

Google My Maps: “Terrain” Base Map

Google Maps | Untitled map | my maps - Google Search

https://www.google.com/maps/d/u/0/edit?mid=zItiMzPdjRfg.kViCJIgCOOAQ

+Brent Search Images Maps Play YouTube News Gmail More

Untitled map

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Untitled layer

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Add places to this layer by drawing or importing data. Learn more

Base map

Share

Google My Maps: “Simple Atlas” Base Map

Google Maps | Untitled map | my maps - Google Search

https://www.google.com/maps/d/u/0/edit?mid=zItiMzPdjRfg.kViCJIgCOOAQ

+Brent Search Images Maps Play YouTube News Gmail More

Untitled map

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Untitled layer

Import

Add places to this layer by drawing or importing data. Learn more

Base map

Share

Google My Maps: “Whitewater” Base Map

Cartography

Spatial Computing – University of Minnesota

Attributions

Cartography

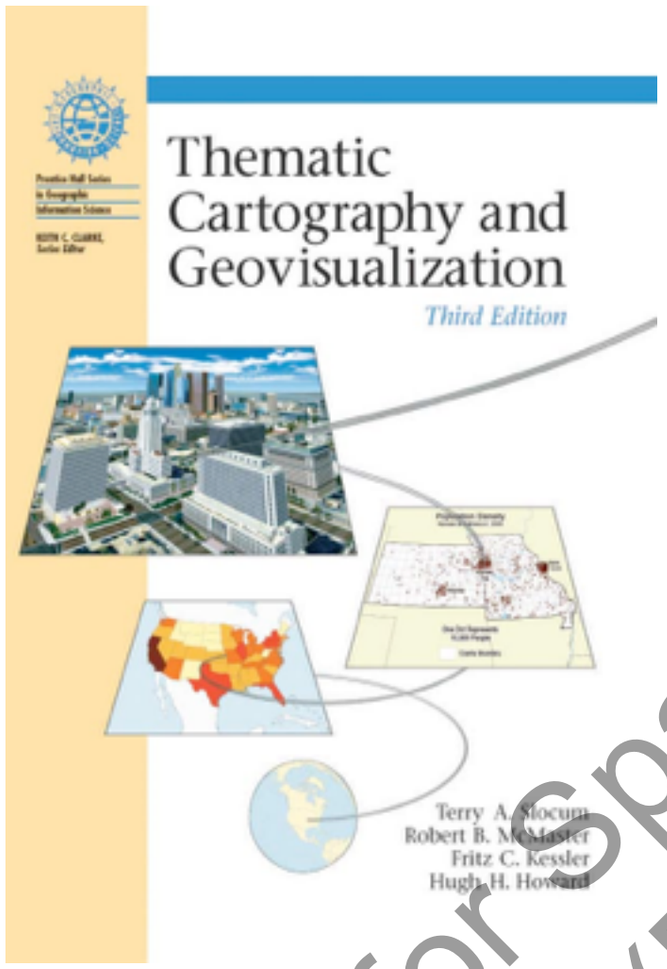
Spatial Computing – University of Minnesota

Cartography

Spatial Computing – University of Minnesota

Learning Objectives

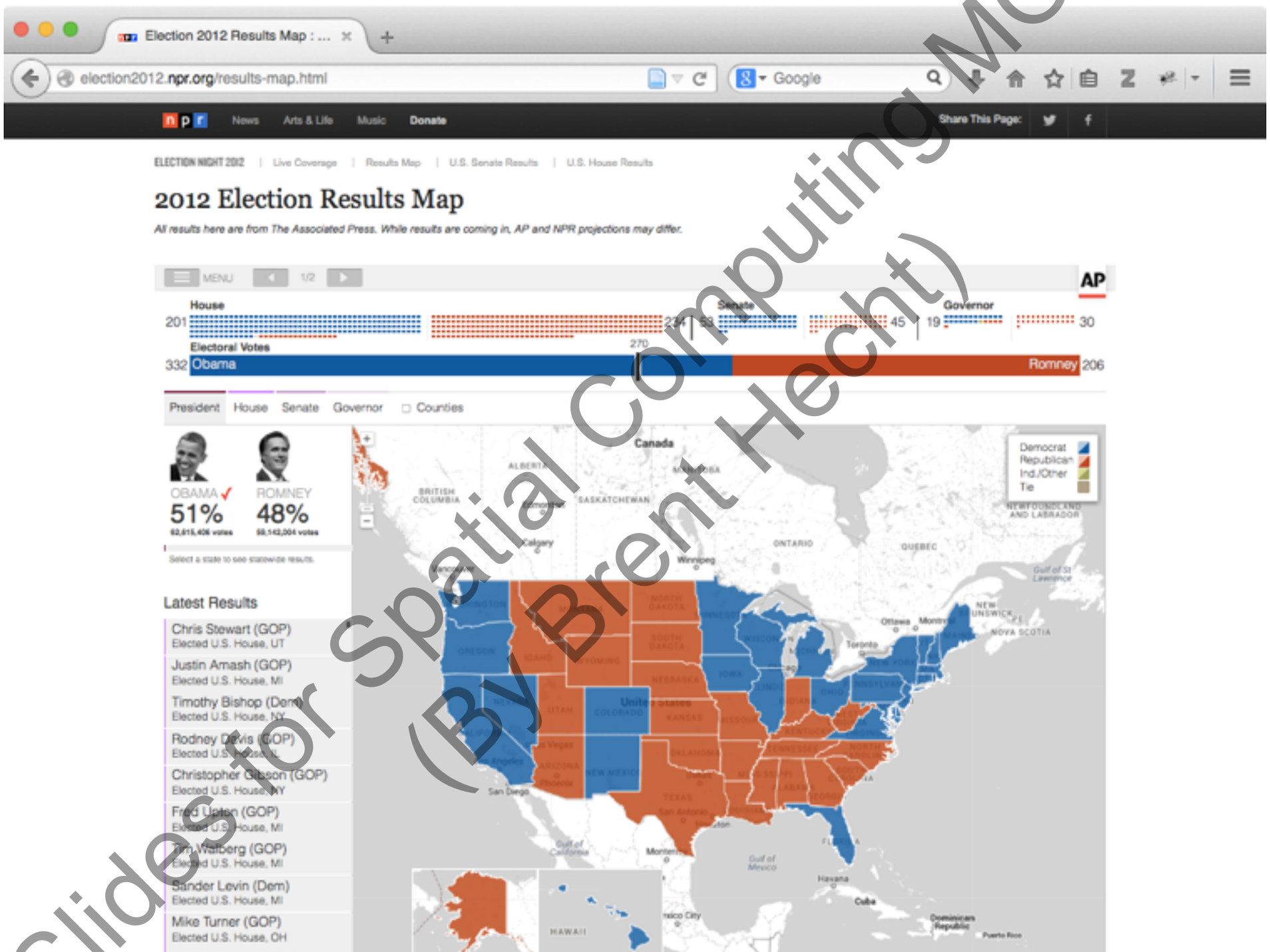
1. Understand the drastically **changed** (and changing) **professional context** of modern cartography.
2. Be able to distinguish between and understand the purpose of the two major types of maps: **reference and thematic**.
3. Know the **limitations** of popular online and mobile reference maps. (Technical track: Know how to get around them)
4. Be able to distinguish between types of **thematic maps** and choose the correct type for a given ***geocommunication*** need.
5. Have an understanding of some of the **computing-oriented innovation** going on in cartography (i.e. ***spatialization***)



(Slocum et al. 2009)

Thematic maps are "used to emphasize the **spatial distribution** of one or more geographic attributes".

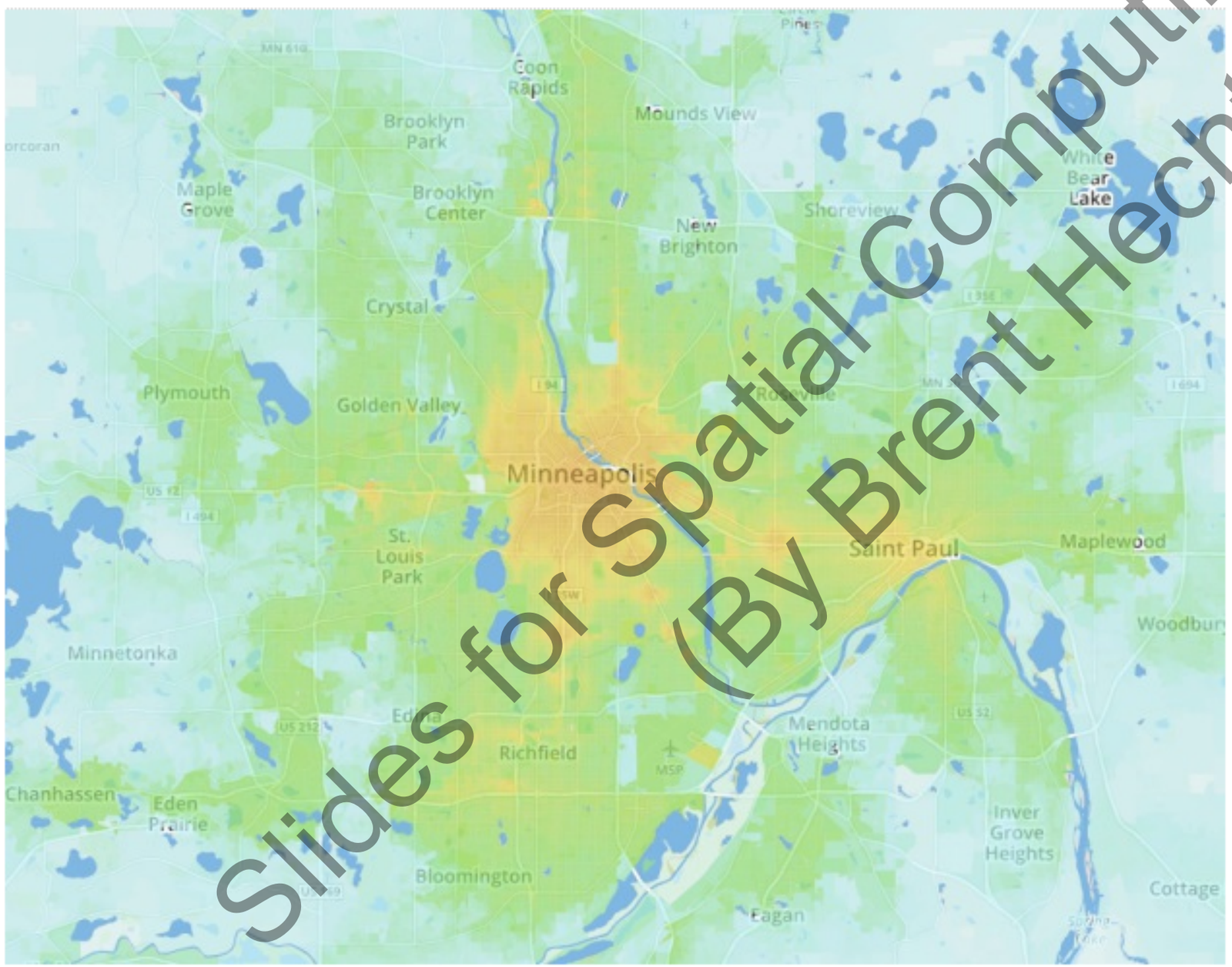
Election maps:



http://election2012.npr.org/results-map.html

MAP: The best places to be a Twin Cities transit commuter

Posted by: Eric Roper | Updated: October 7, 2014 - 5:43 PM



Above: Number of jobs accessible from different points within 30 minutes, between 7 a.m. and 9 a.m. Click here to see the full map, with a legend.

recent posts

- 2 Minneapolis officers praised for saving man stabbed downtown
- Man with dog shoots up 19 Bar, wounding two before fleeing
- Minneapolis seeks high-rise for Nicollet Hotel

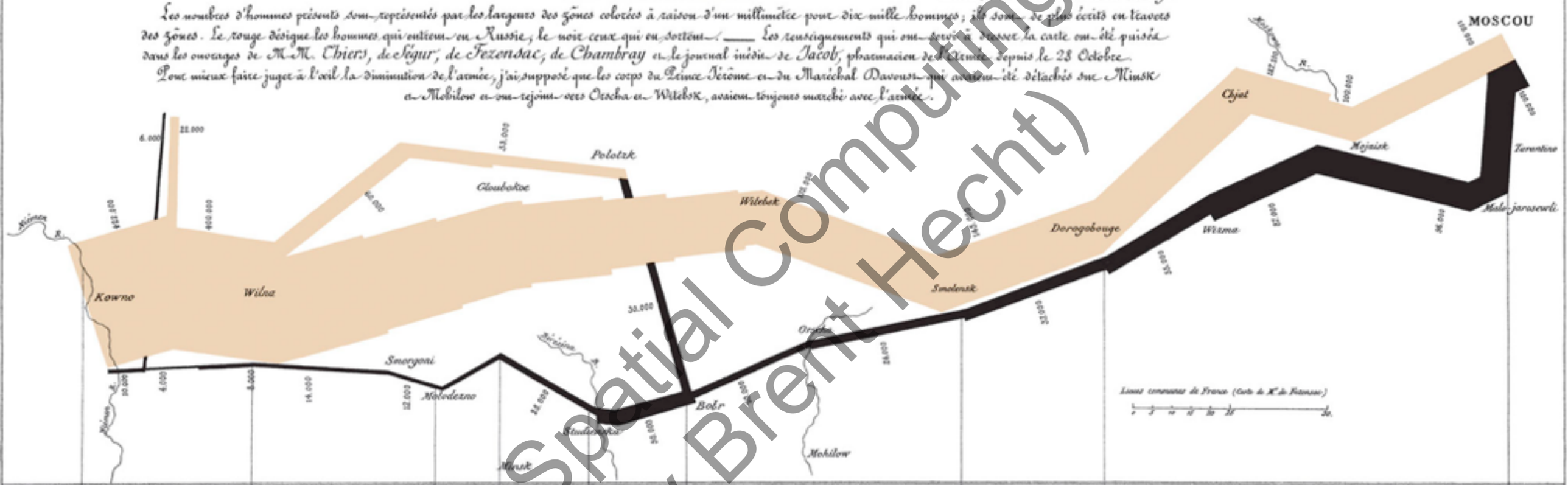
Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.

Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zônes colorées à raison d'un millimètre pour dix mille hommes ; ils sont de plus écrits en travers des zônes. Le rouge désigne les hommes qui entrèrent en Russie, le noir ceux qui en sortirent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de MM. Thiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

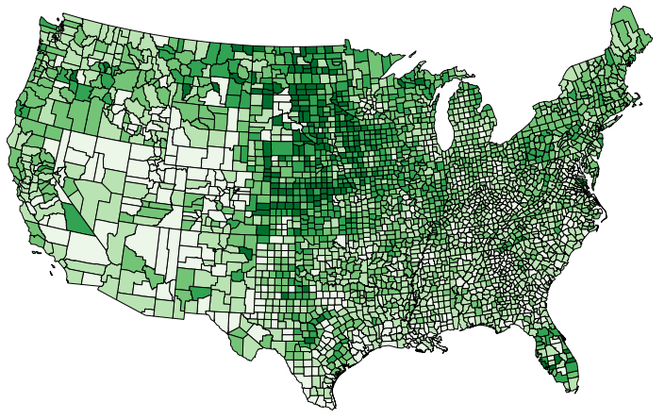
Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davoust qui avaient été détachés sur Minsk et Mohilow et qui rejoignirent vers Orscha et Witebsk, avaient toujours marché avec l'armée.



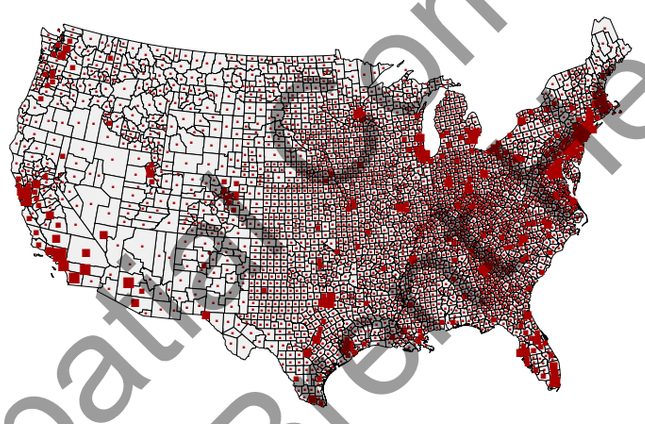
Autog. par Regnier, 8. Pas. Stre Marie St Gdre à Paris.

Imp. Lith. Regnier et Bourdet.

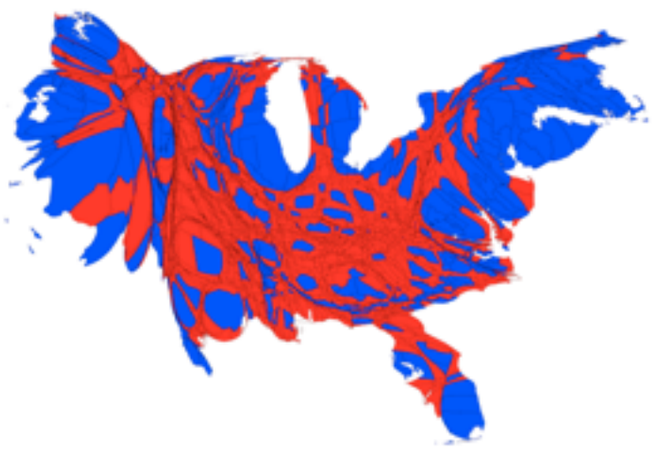
Types of thematic maps we're going to cover:



Choropleth



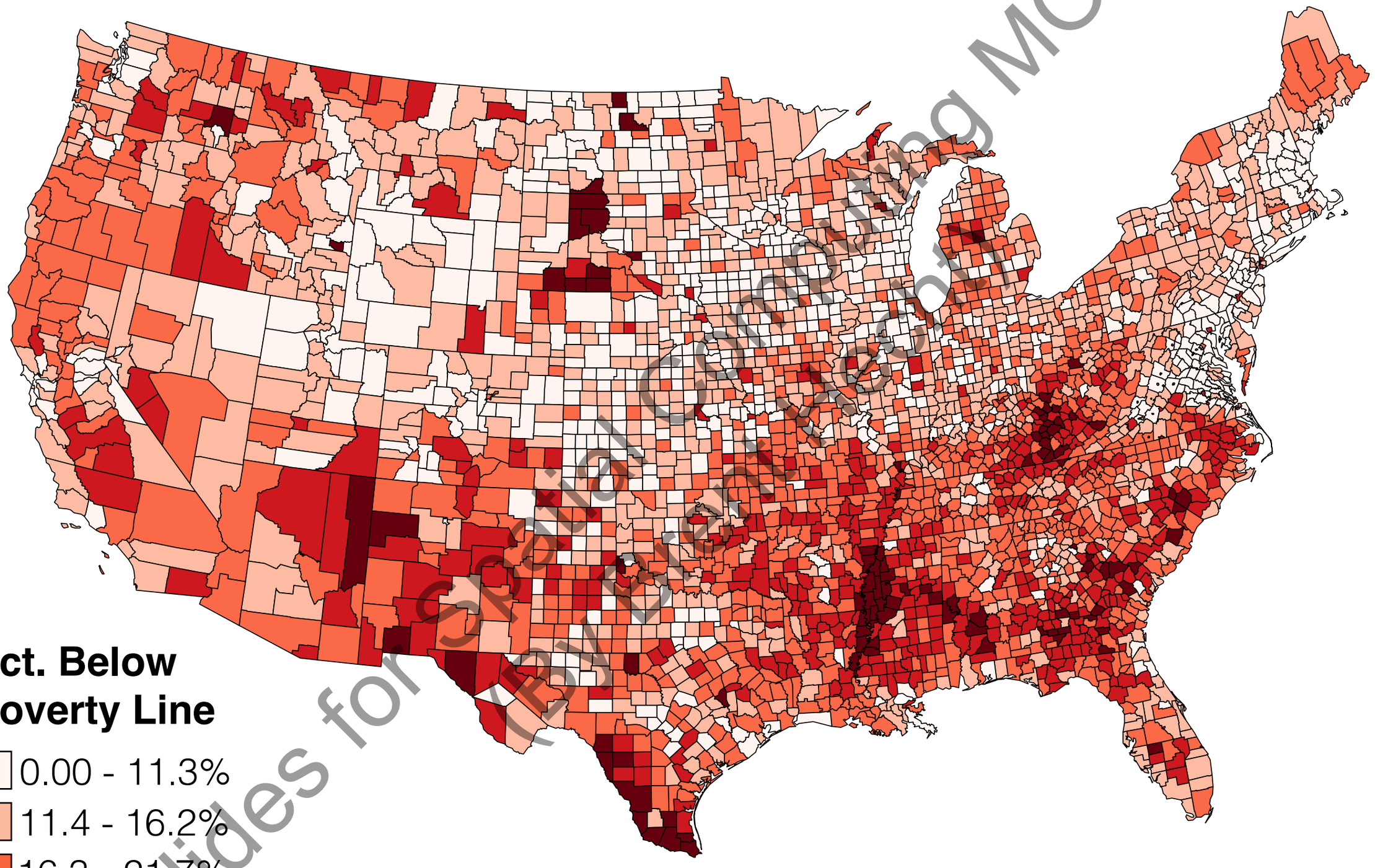
Graduated / Proportional Symbol



Cartograms

Poverty in the United States

Percent of the Population Below the Poverty Line



Data sources: U.S. Census American Community Survey 2006-2010, ESRI
Classification: Natural Breaks

COLOR-related challenges when making **choropleth** maps:

1. Deciding on the set of colors you will use

2. Deciding how to assign colors to specific data values (data classification)

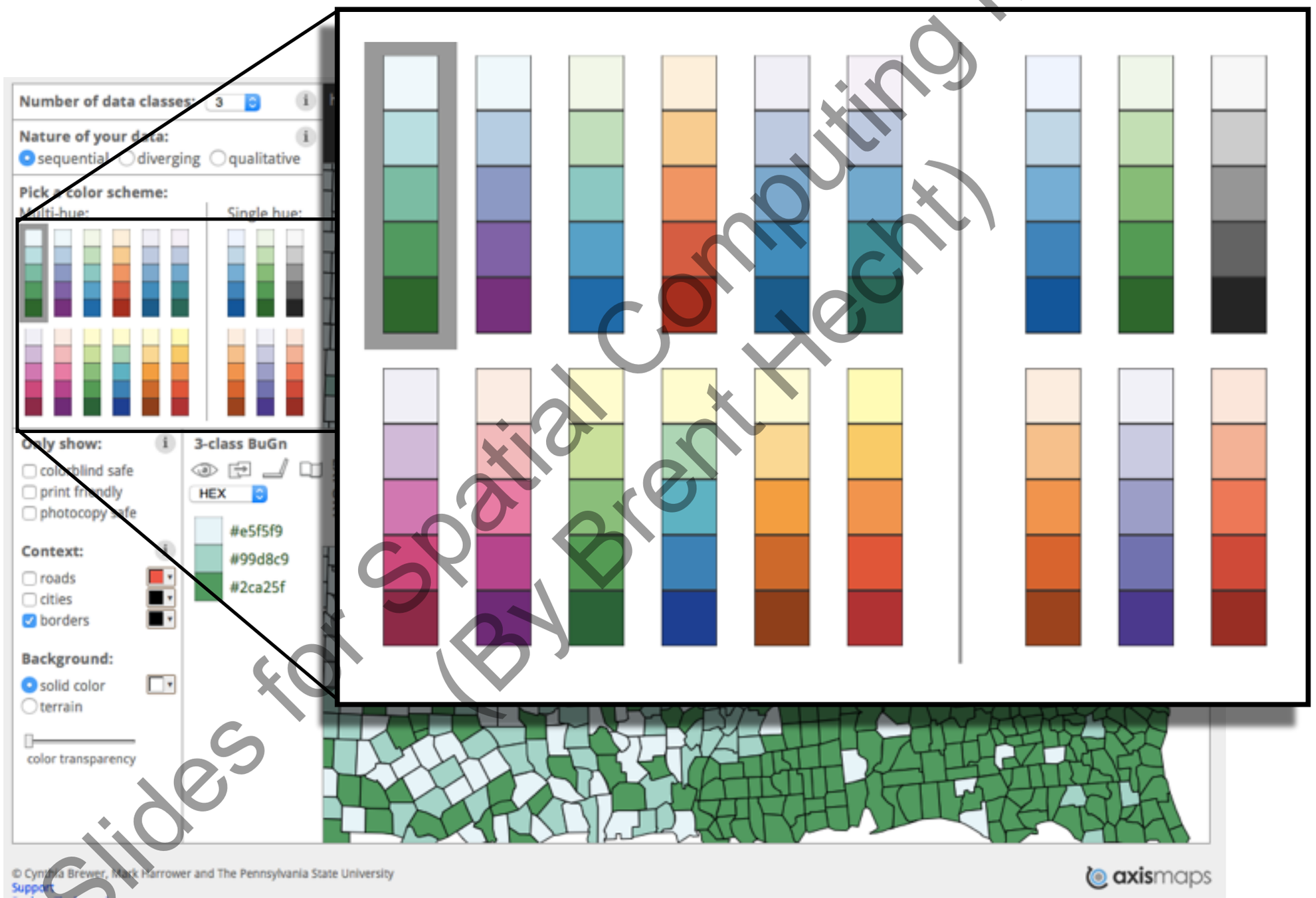
COLOR-related challenges when making **choropleth** maps:

1. Deciding on the set of colors you will use

QUANTITATIVE attributes

QUALITATIVE attributes

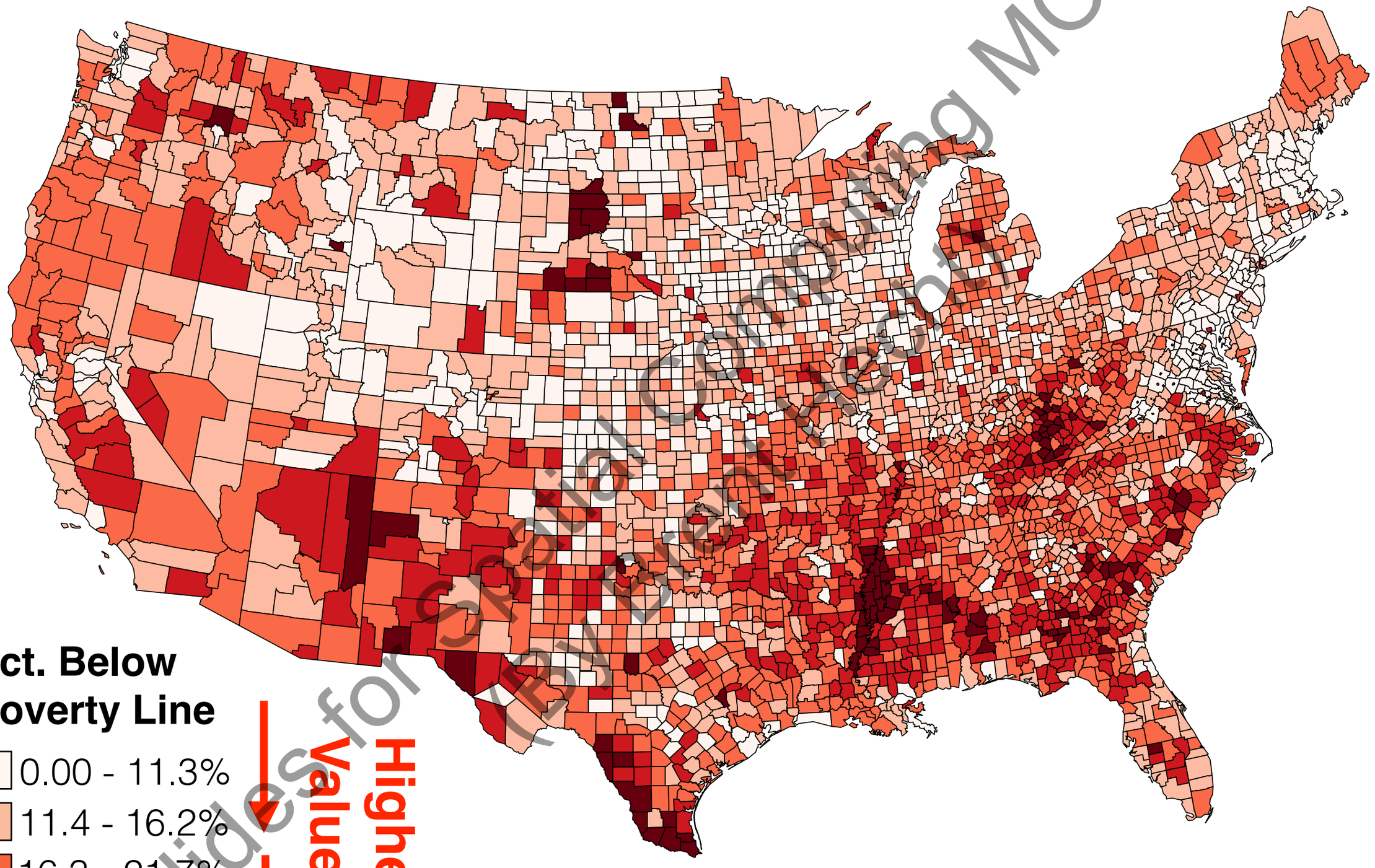
With **quantitative** attributes, you want color schemes like:



colorbrewer.org

Poverty in the United States

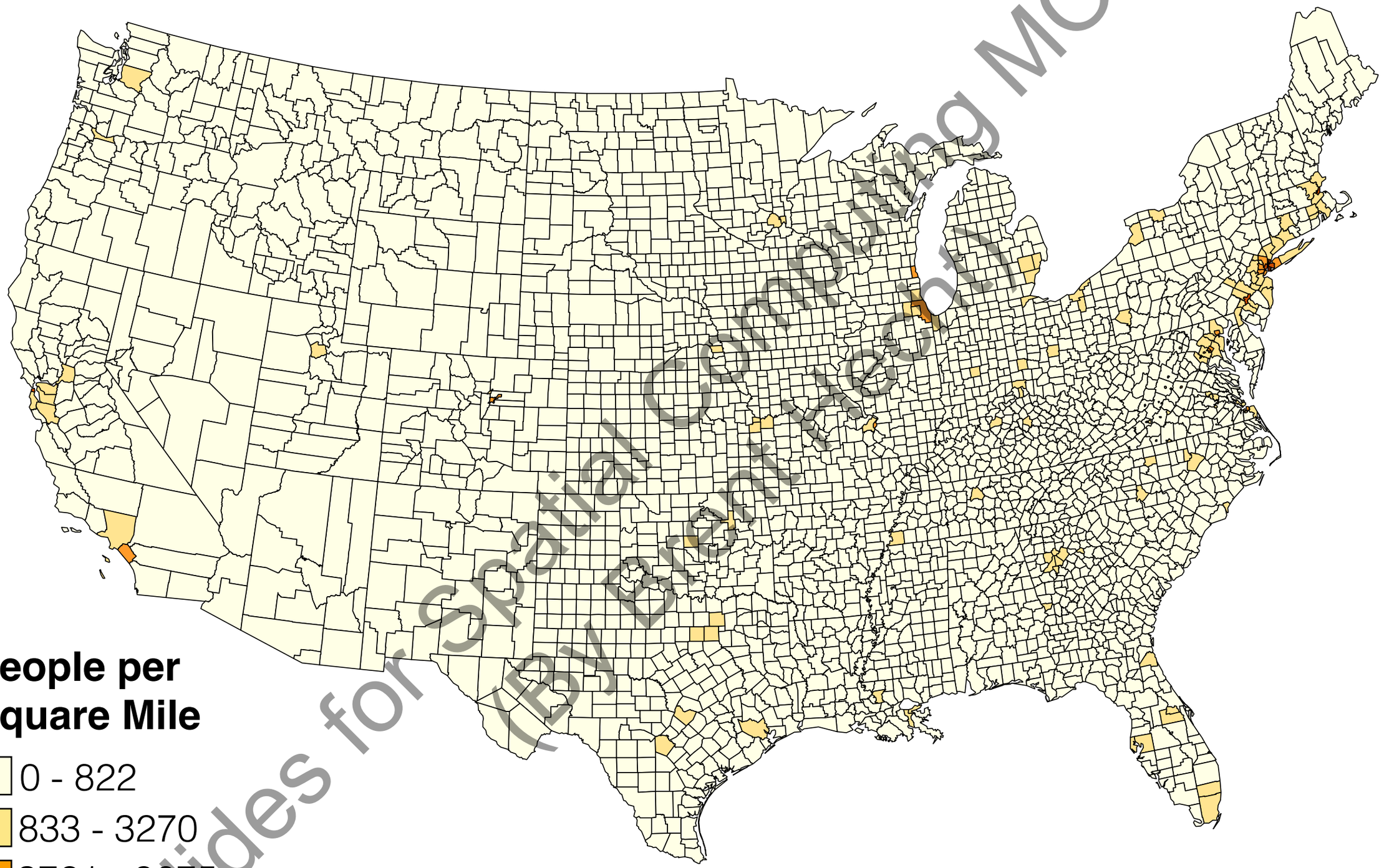
Percent of the Population Below the Poverty Line



Data sources: U.S. Census American Community Survey 2006-2010, ESRI
Classification: Natural Breaks

Population Density in the U.S.

People per Square Mile by County



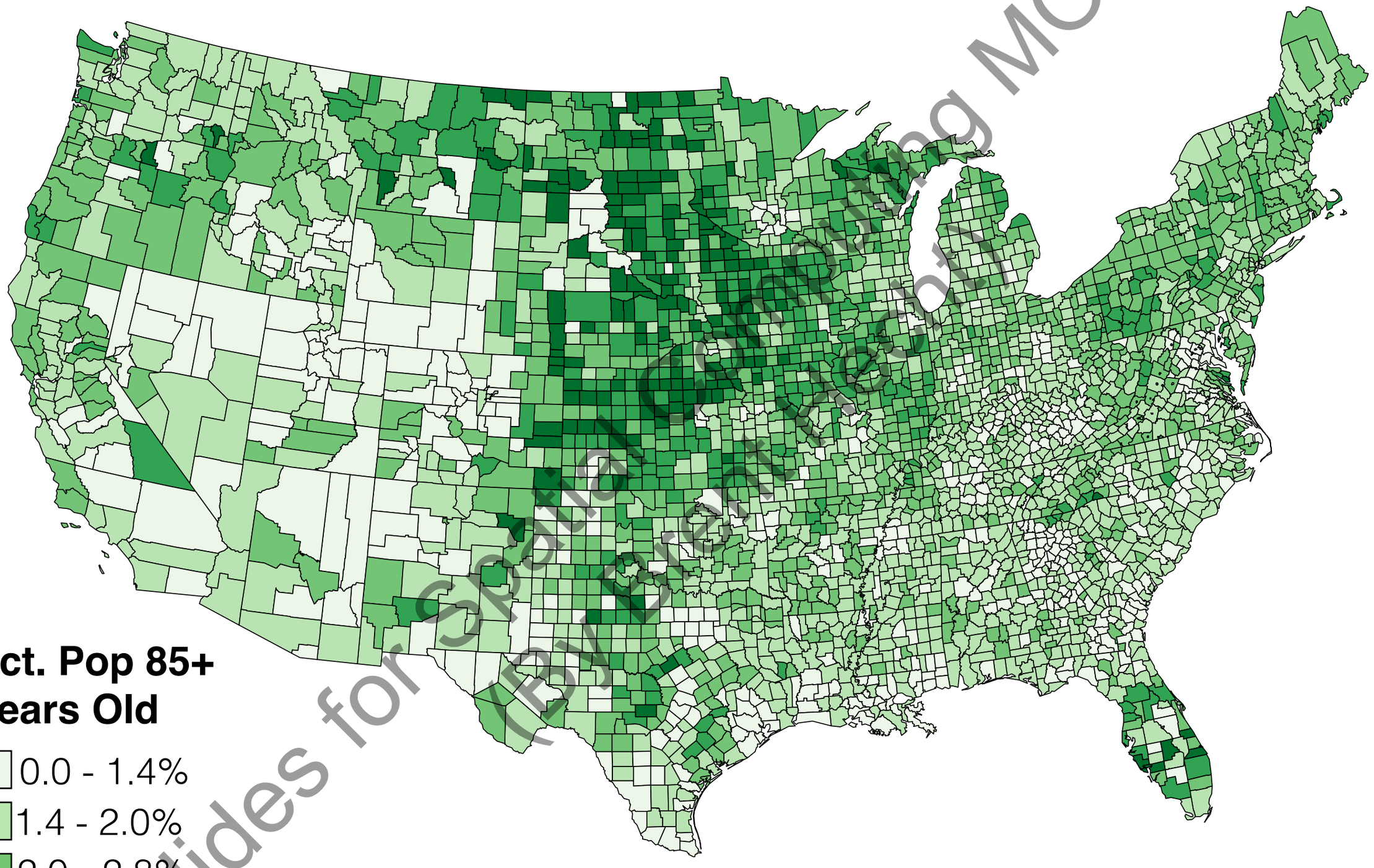
People per Square Mile

- 0 - 822
- 833 - 3270
- 3721 - 9675
- 9676 - 20418
- 20419 - 69568

Data sources: U.S. Census, ESRI
Classification: Natural Breaks

85+ Population in the United States

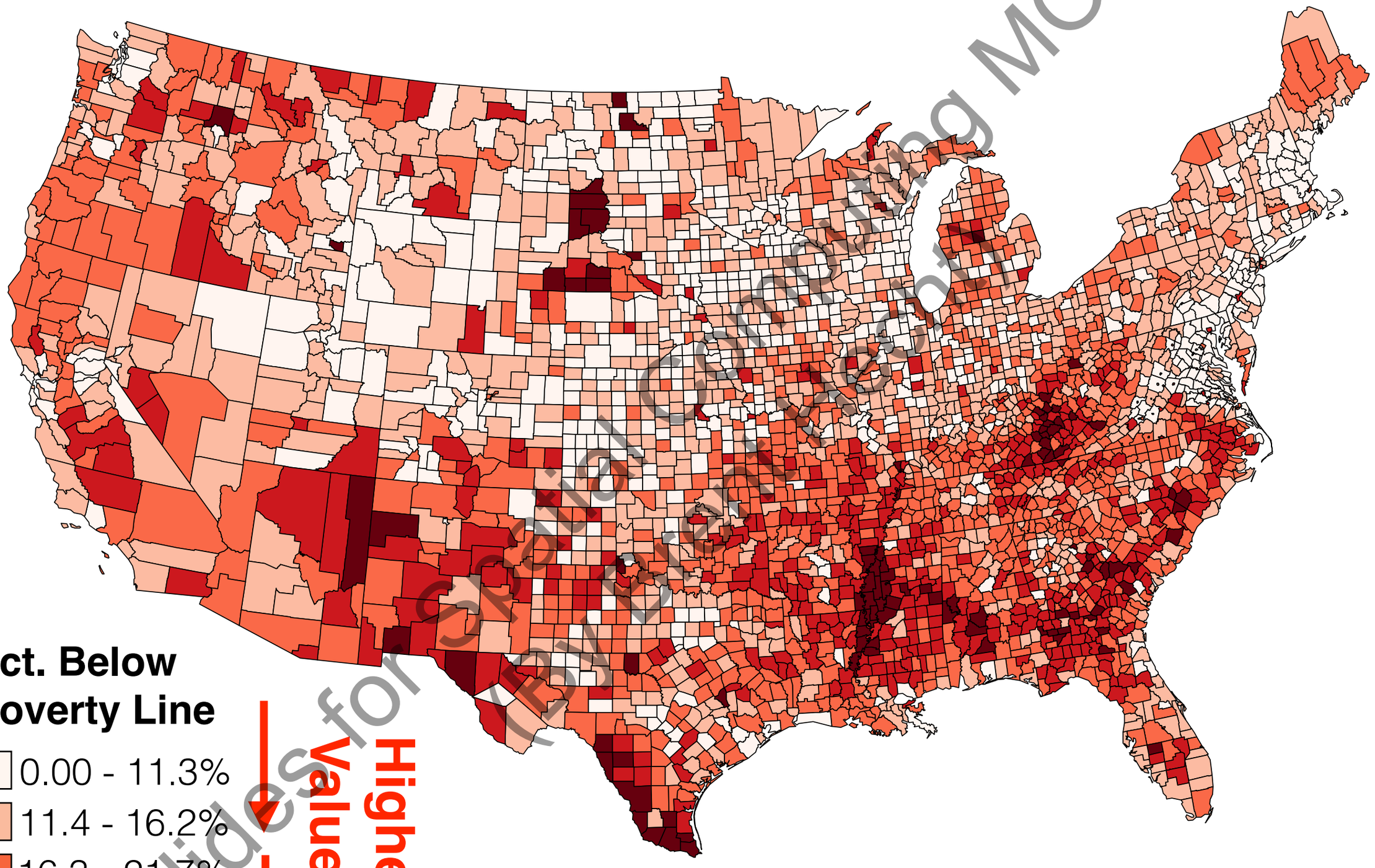
Pct of the Population that is 85 Years Old or Older



Data sources: U.S. Census, ESRI
Classification: Natural Breaks

Poverty in the United States

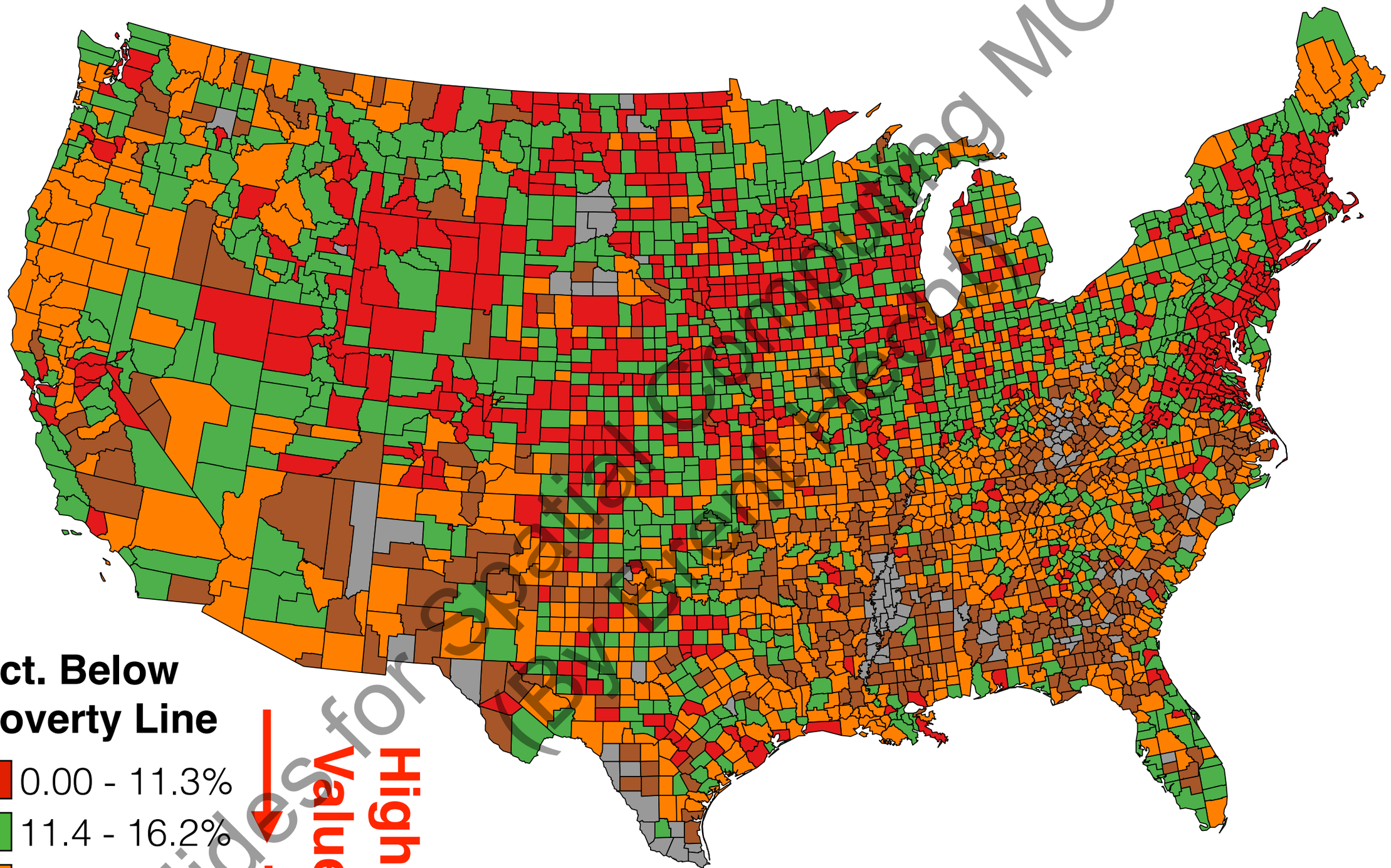
Percent of the Population Below the Poverty Line



Data sources: U.S. Census American Community Survey 2006-2010, ESRI
Classification: Natural Breaks

Poverty in the United States

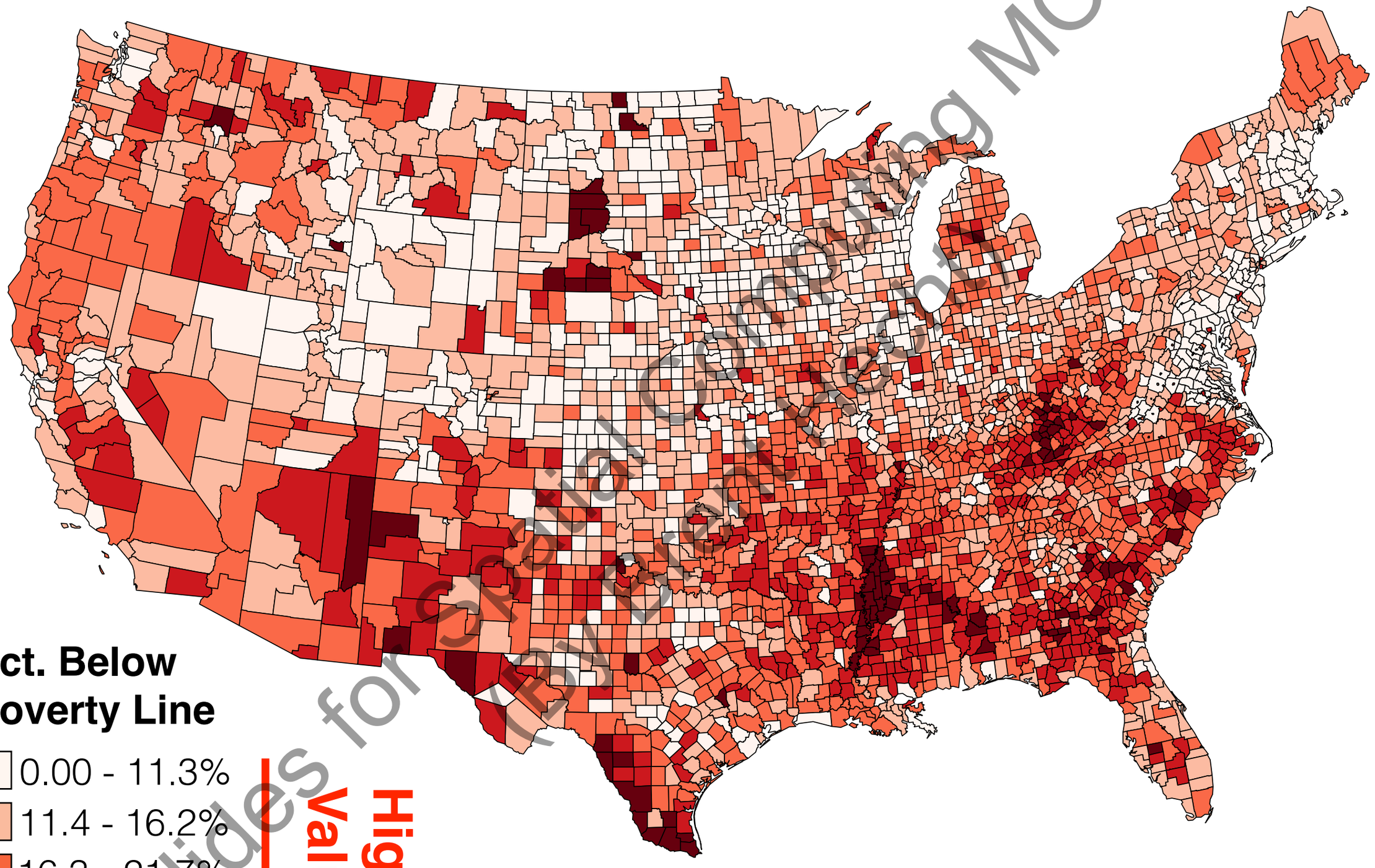
Percent of the Population Below the Poverty Line



Data sources: U.S. Census American Community Survey 2006-2010, ESRI
Classification: Natural Breaks

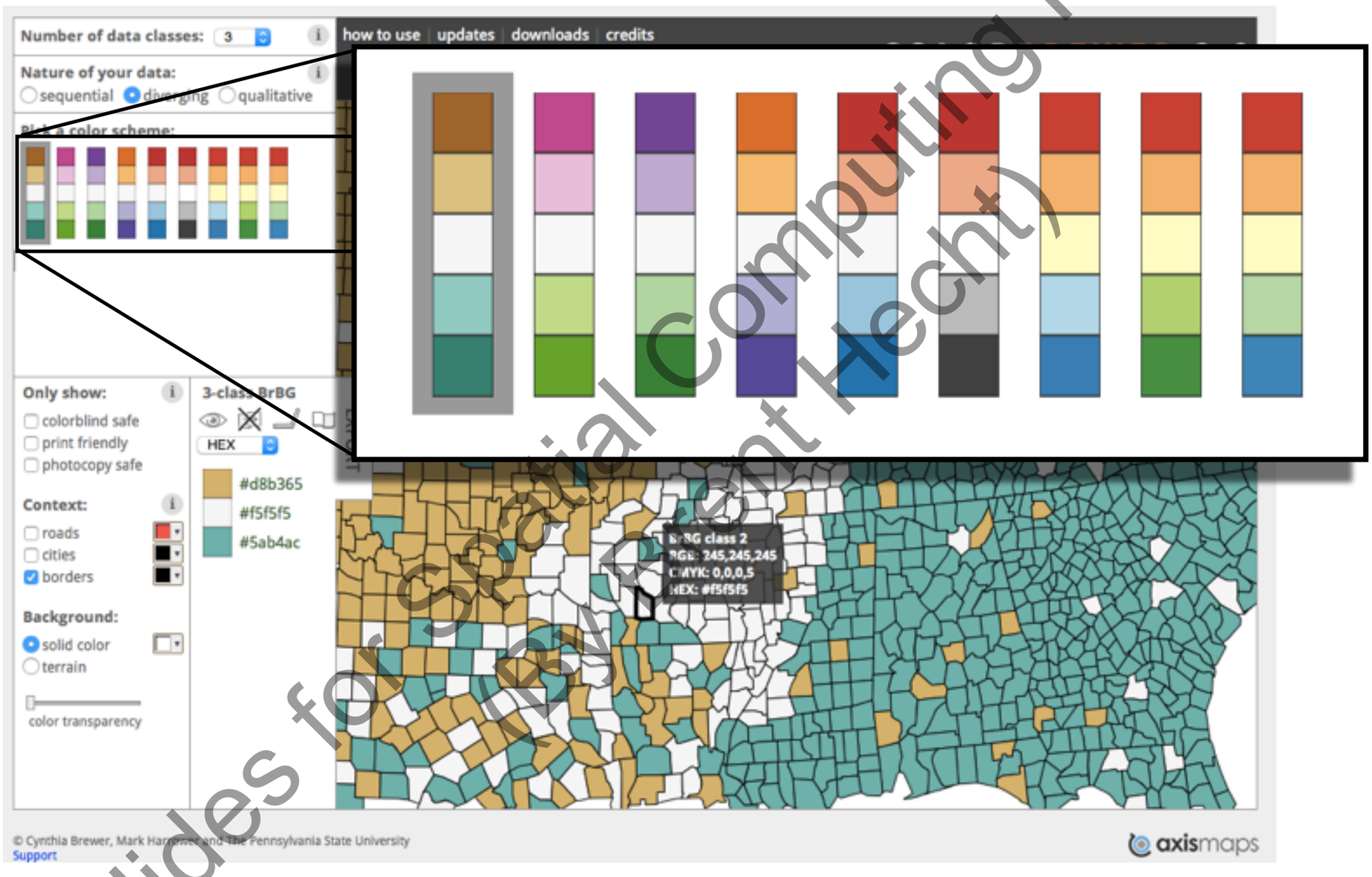
Poverty in the United States

Percent of the Population Below the Poverty Line



Data sources: U.S. Census American Community Survey 2006-2010, ESRI
Classification: Natural Breaks

Divergent color schemes:



Higher Values

colorbrewer.org

President Map - Election 20…

elections.nytimes.com/2012/results/president

Google

President Map

FACEBOOK TWITTER

Map | Big Board | Scenarios | Exit Polls

UPDATED NOV. 29

332 Obama ✔ — 0 undecided — Romney **206**

62,611,250 votes — 270 to win — 59,134,475 votes

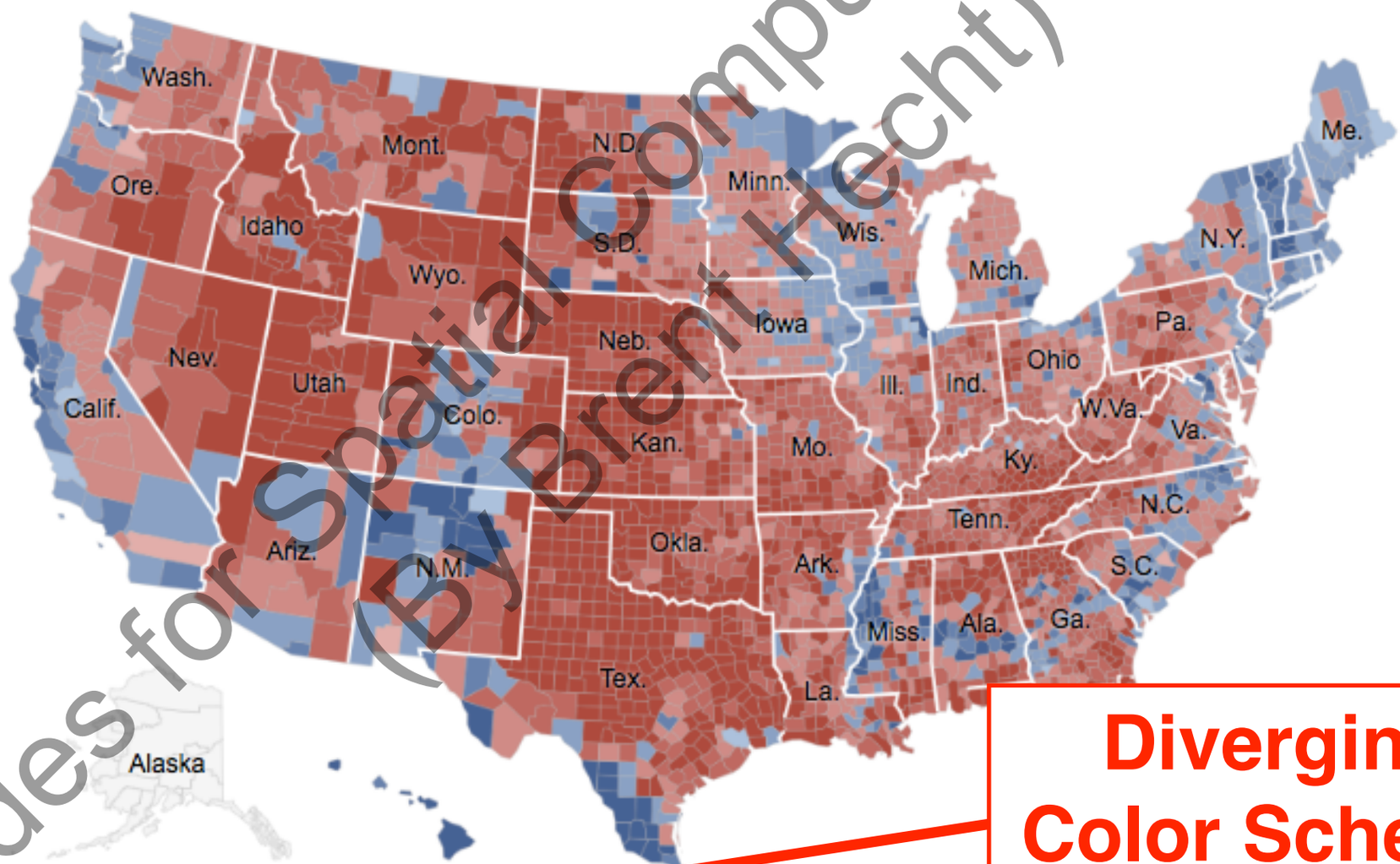
States

States

Counties

Size of lead

Shift from 2008



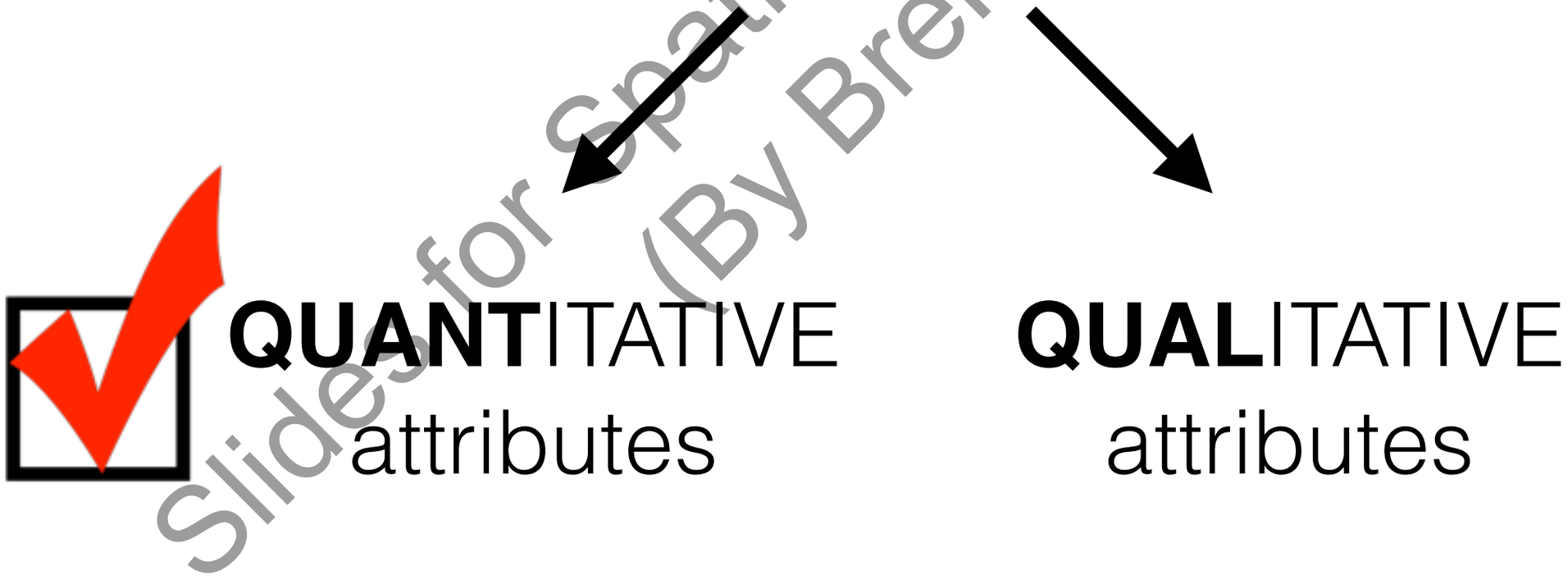
TOP CANDIDATE'S SHARE OF VOTE — DEM. 40% 50 60 70% — REP. 40% 50 60 70% — IND. 40% 50 60 70%

Battleground states are called by New York Times editors. Other states are by The Associated Press.

Diverging Color Scheme

COLOR-related challenges when making **choropleth** maps:

1. Deciding on the set of colors you will use



Examples of **qualitative** spatial attributes:

1. Land cover type (e.g urban, forest, water)
2. The primary religion in an area
3. The primary language spoken in area
4. The region of an area like East Coast, West Coast, Midwest, etc.

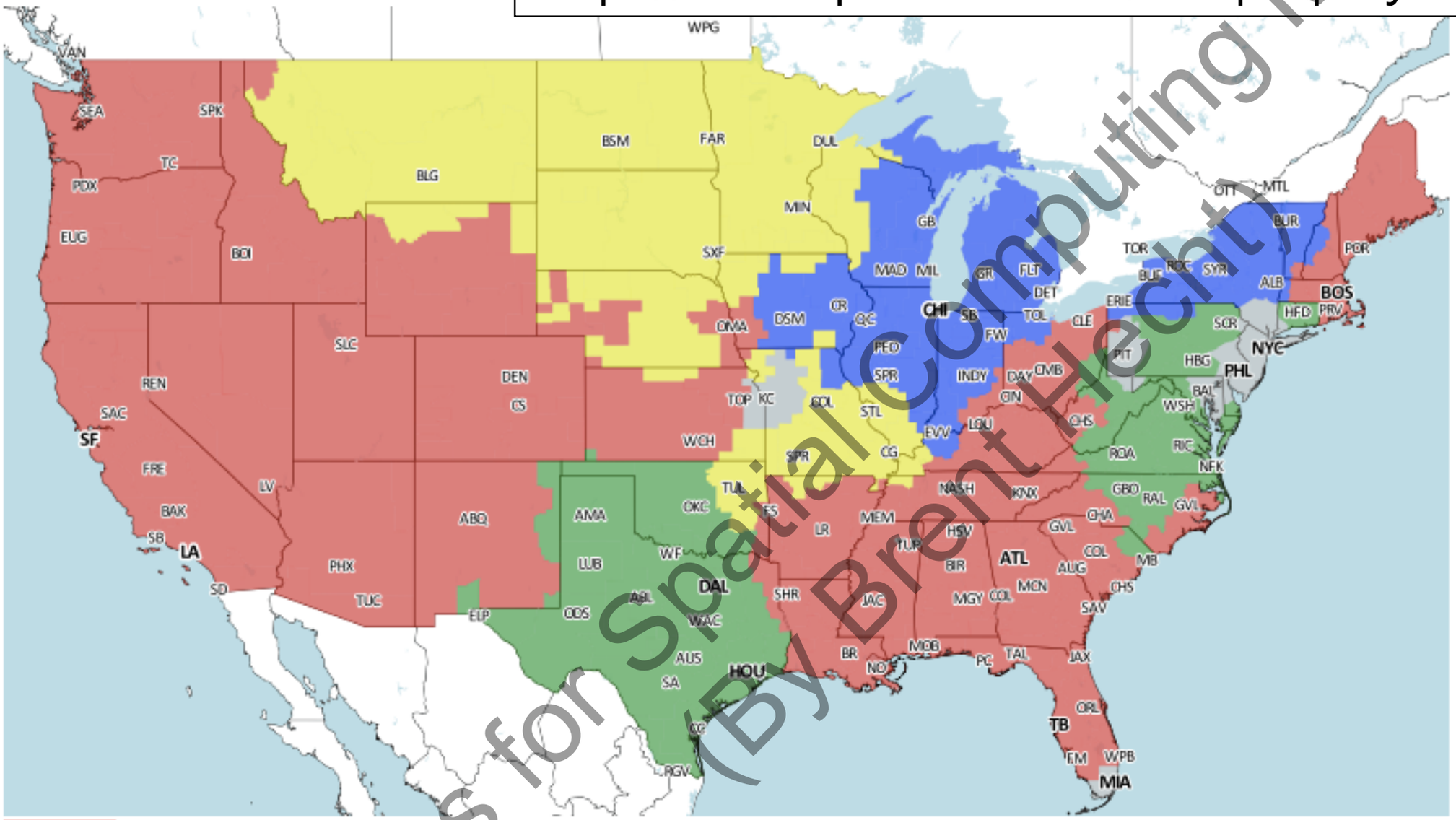
506 Sports - NFL Maps: We…

http://506sports.com/nfl.php?yr=2014&wk=1

Google

FOX EARLY

http://506sports.com/nfl.php?yr=2014&wk=1



New Orleans @ Atlanta -- Kevin Burkhardt, John Lynch [Anchorage AK; HI]

Buffalo @ Chicago -- Kenny Albert, Daryl Johnston, Tony Siragusa

Washington @ Houston -- Thom Brennaman, David Diehl

Minnesota @ St. Louis -- Dick Stockton, Kirk Morrison [Fairbanks AK]

NO GAME due to NFL rules

UPDATES:

Boston MA: BUF-CHI to NO-ATL

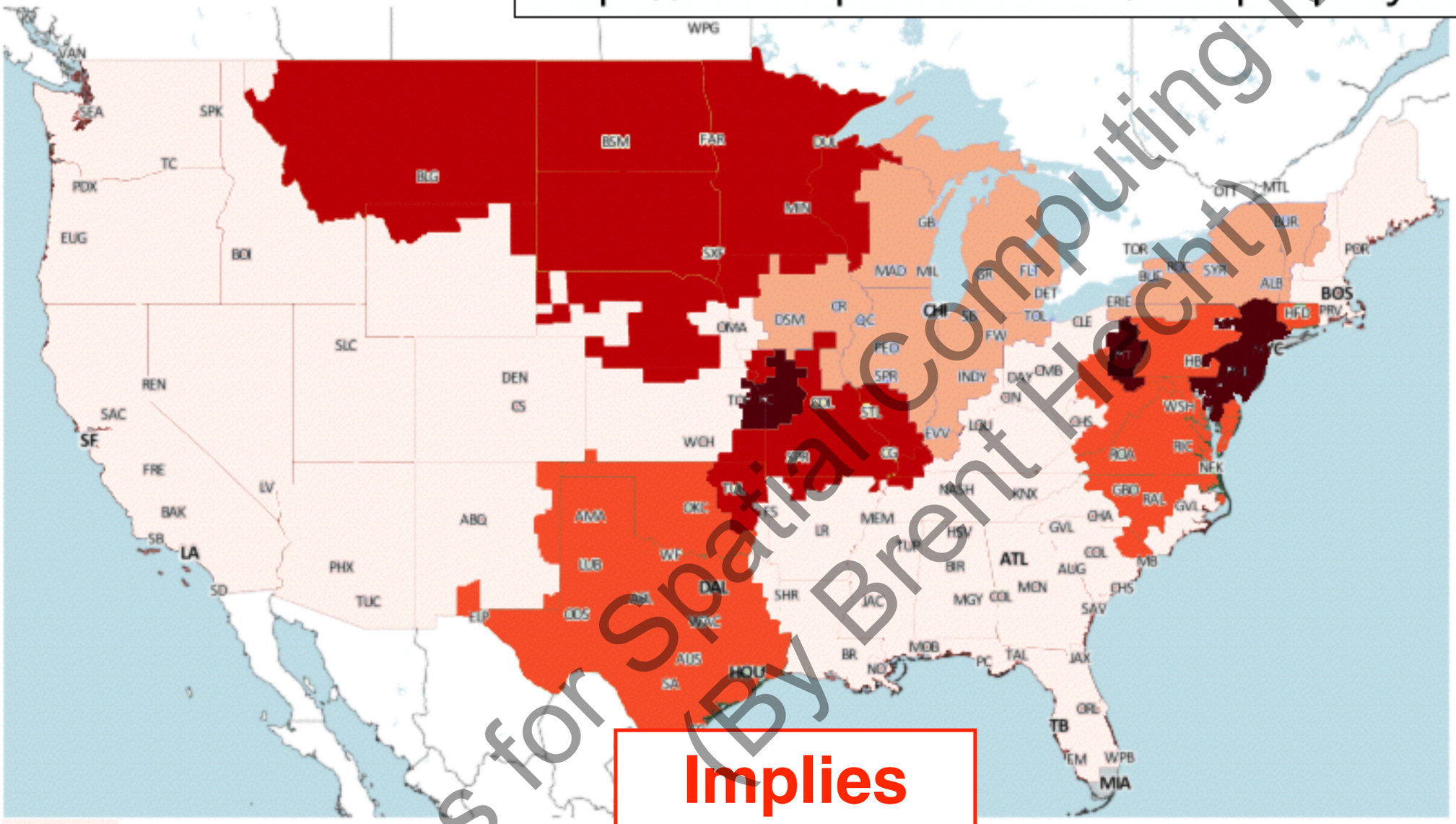
506 Sports - NFL Maps: We…

http://506sports.com/nfl.php?yr=2014&wk=1

Google

FOX EARLY

http://506sports.com/nfl.php?yr=2014&wk=1



New Orleans @ Atlanta -- Kevin Burkhard… [HI]

Buffalo @ Chicago -- Kenny Albert, Daryl…

Washington @ Houston -- Thom Brennan…

Minnesota @ St. Louis -- Dick Stockton, K…

NO GAME due to NFL rules

UPDATES:

Boston MA: BUF-CHI to NO-ATL

Implies increasing values

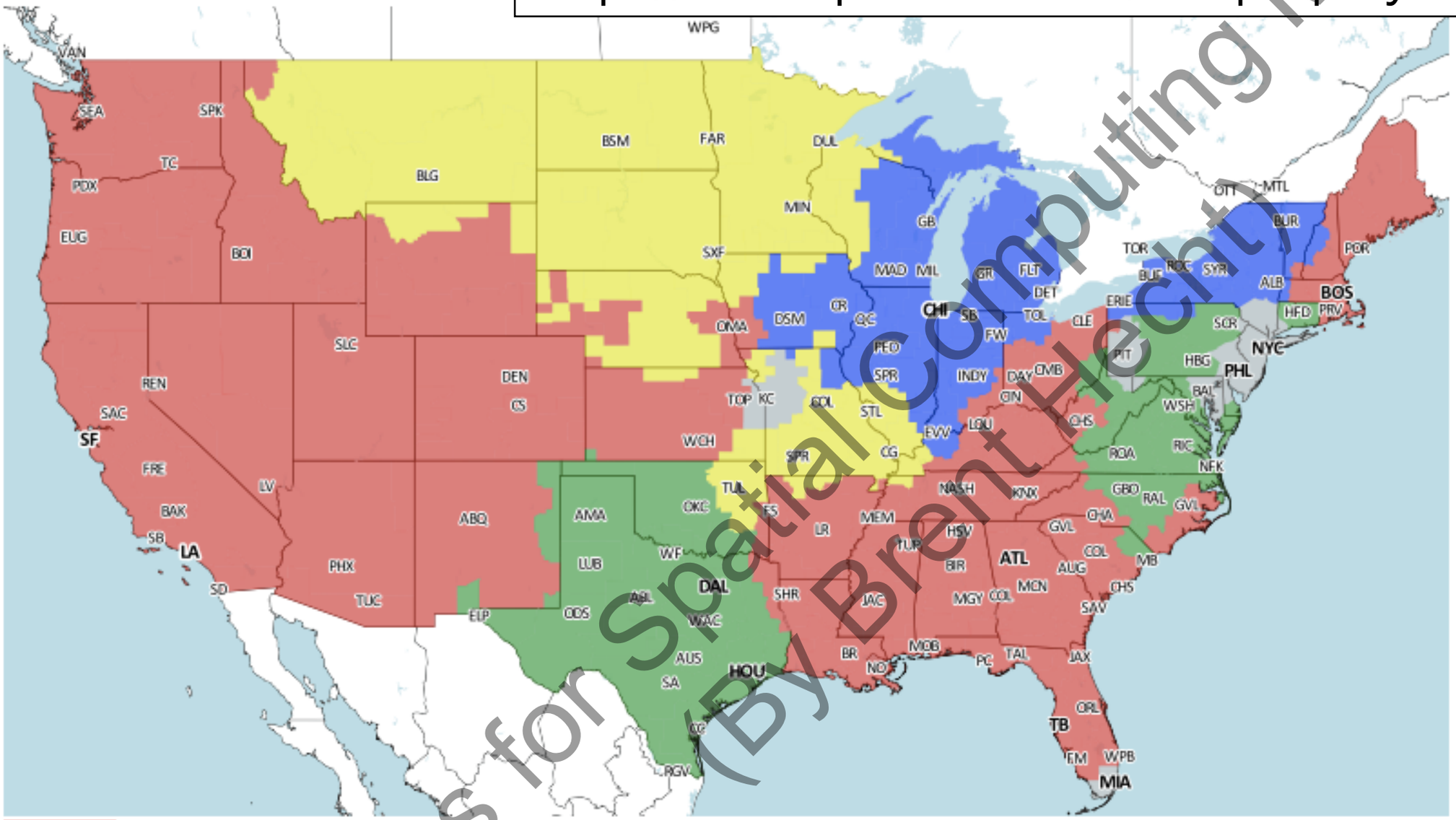
506 Sports - NFL Maps: We…

http://506sports.com/nfl.php?yr=2014&wk=1

Google

FOX EARLY

http://506sports.com/nfl.php?yr=2014&wk=1



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NO GAME due to NFL rules

UPDATES:

Boston MA: BUF-CHI to NO-ATL

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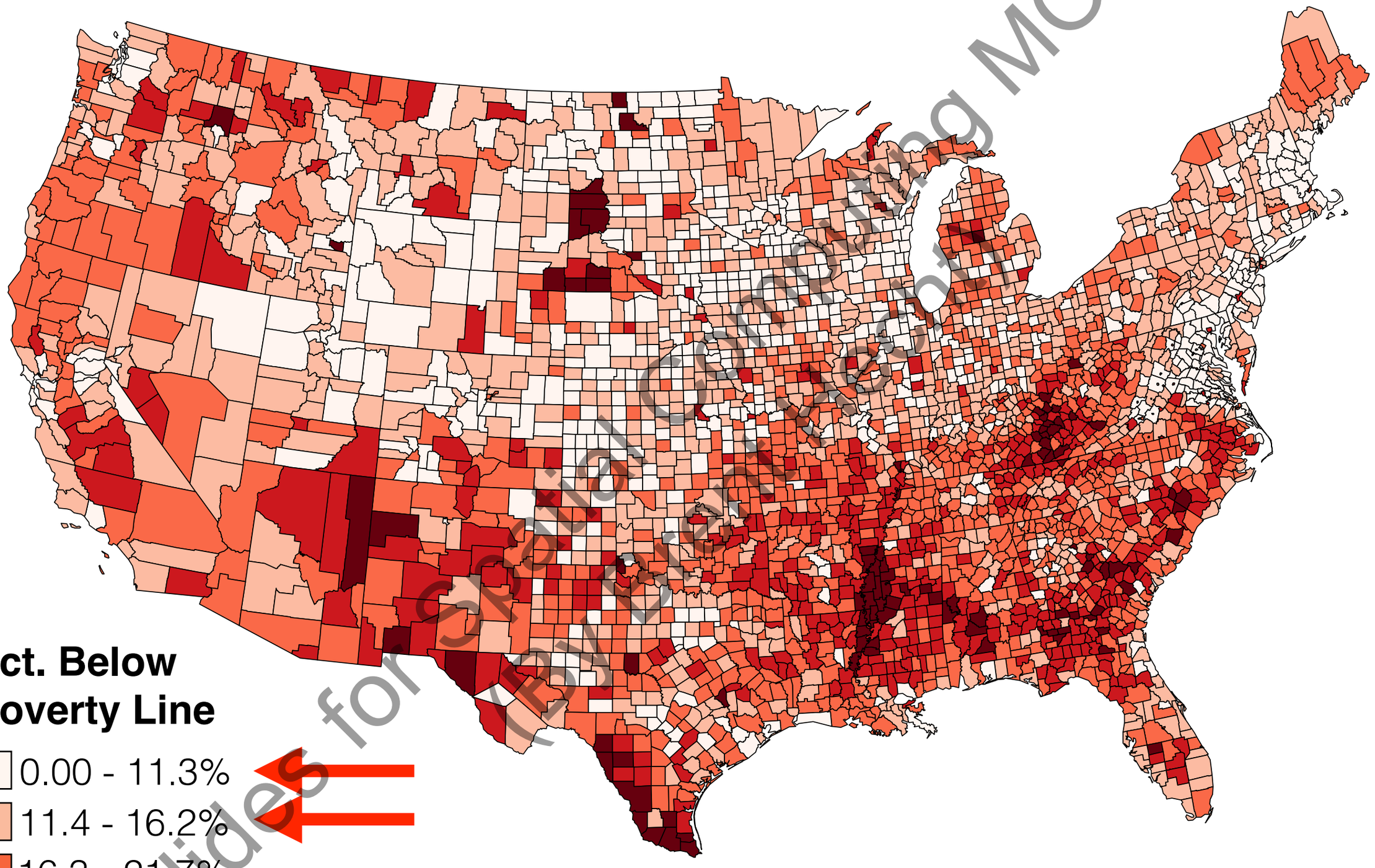
Poverty in the United States

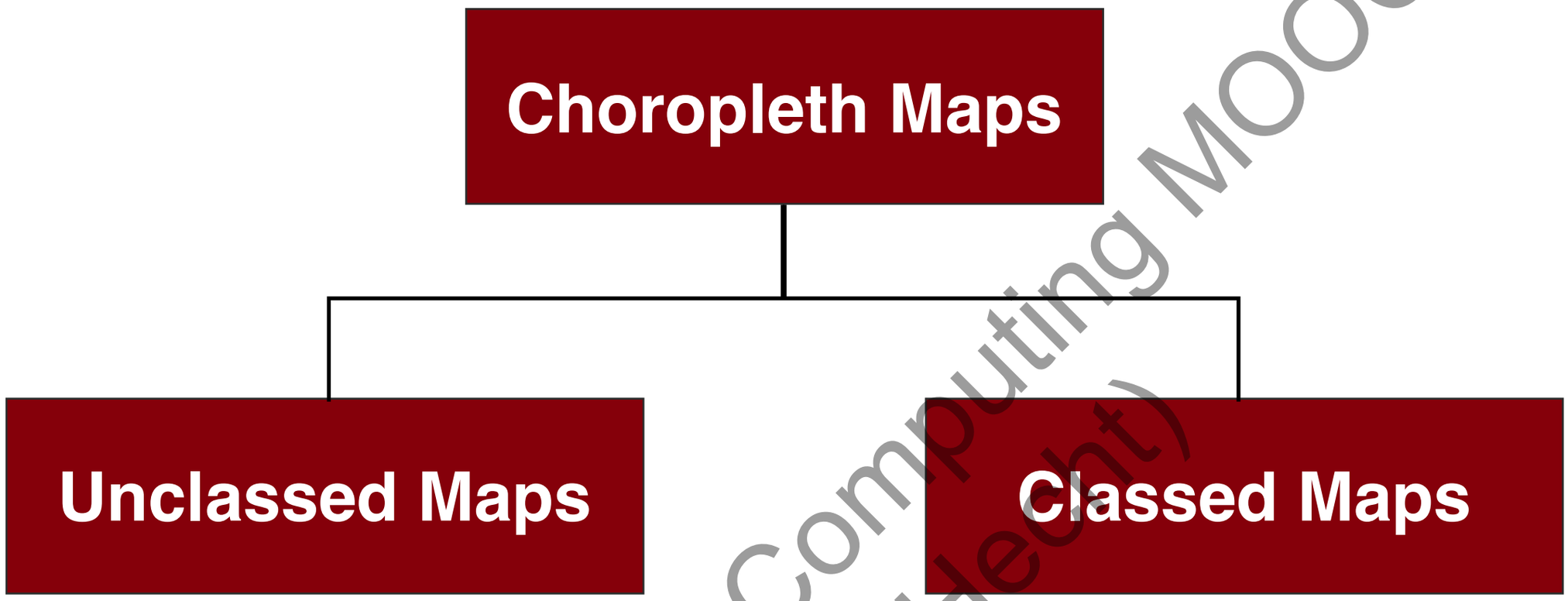
Percent of the Population Below the Poverty Line



Pct. Below Poverty Line

- 0.00 - 11.3%
- 11.4 - 16.2%
- 16.3 - 21.7%
- 21.8 - 29.6%
- 29.7 - 49.5%

Data sources: U.S. Census American Community Survey 2006-2010, ESRI
Classification: Natural Breaks



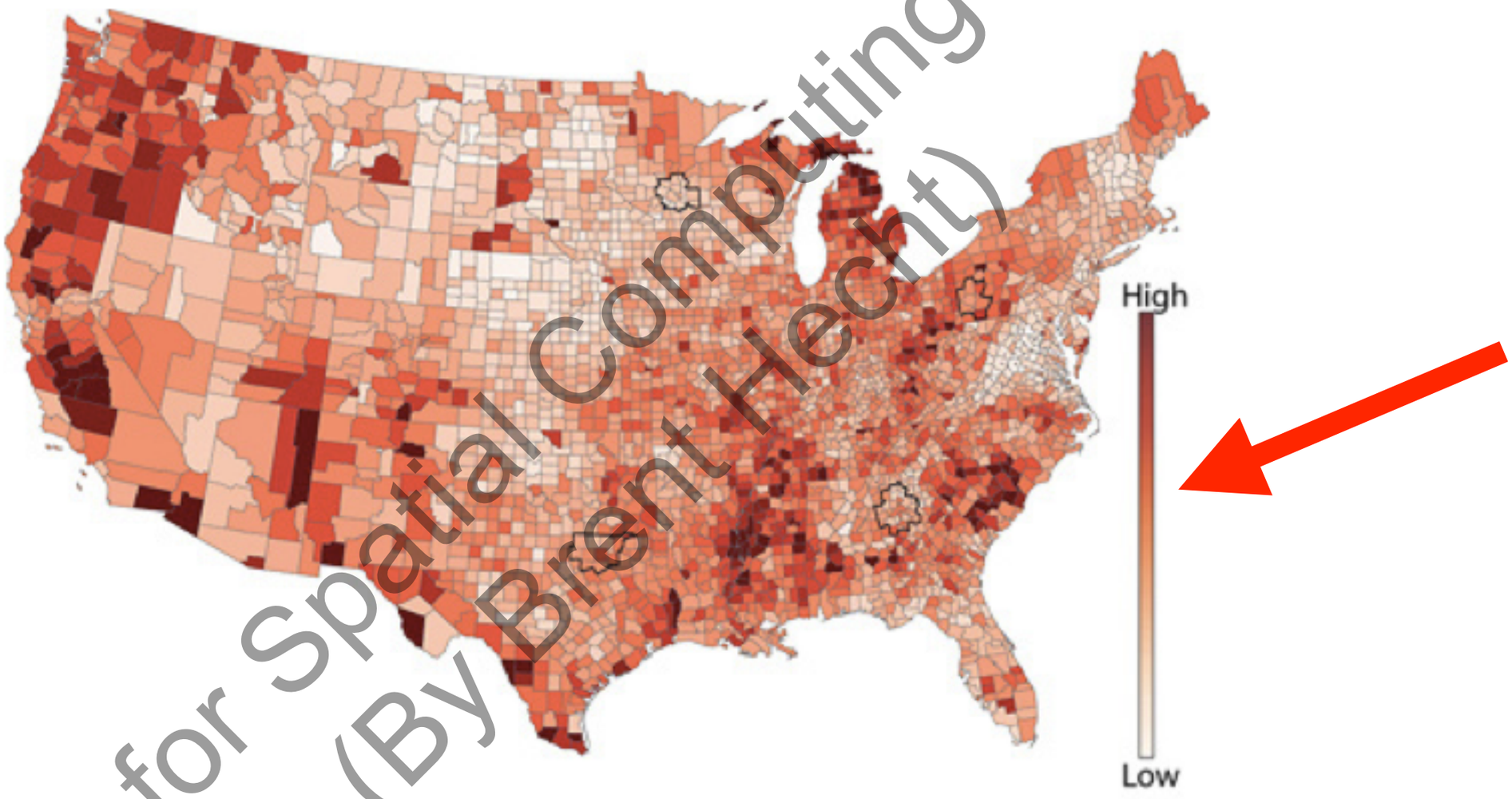
Choropleth Maps - indiemap…

indiemapper.com/app/learnmore.php?l=choropleth

Google

Example Unclassed Choropleth Map

In the map below, notice how you can easily see a large geographic pattern of unemployment rates, but it is very hard to compare or rank counties: try to accurately arrange the counties in California from lowest to highest...it's nearly impossible.



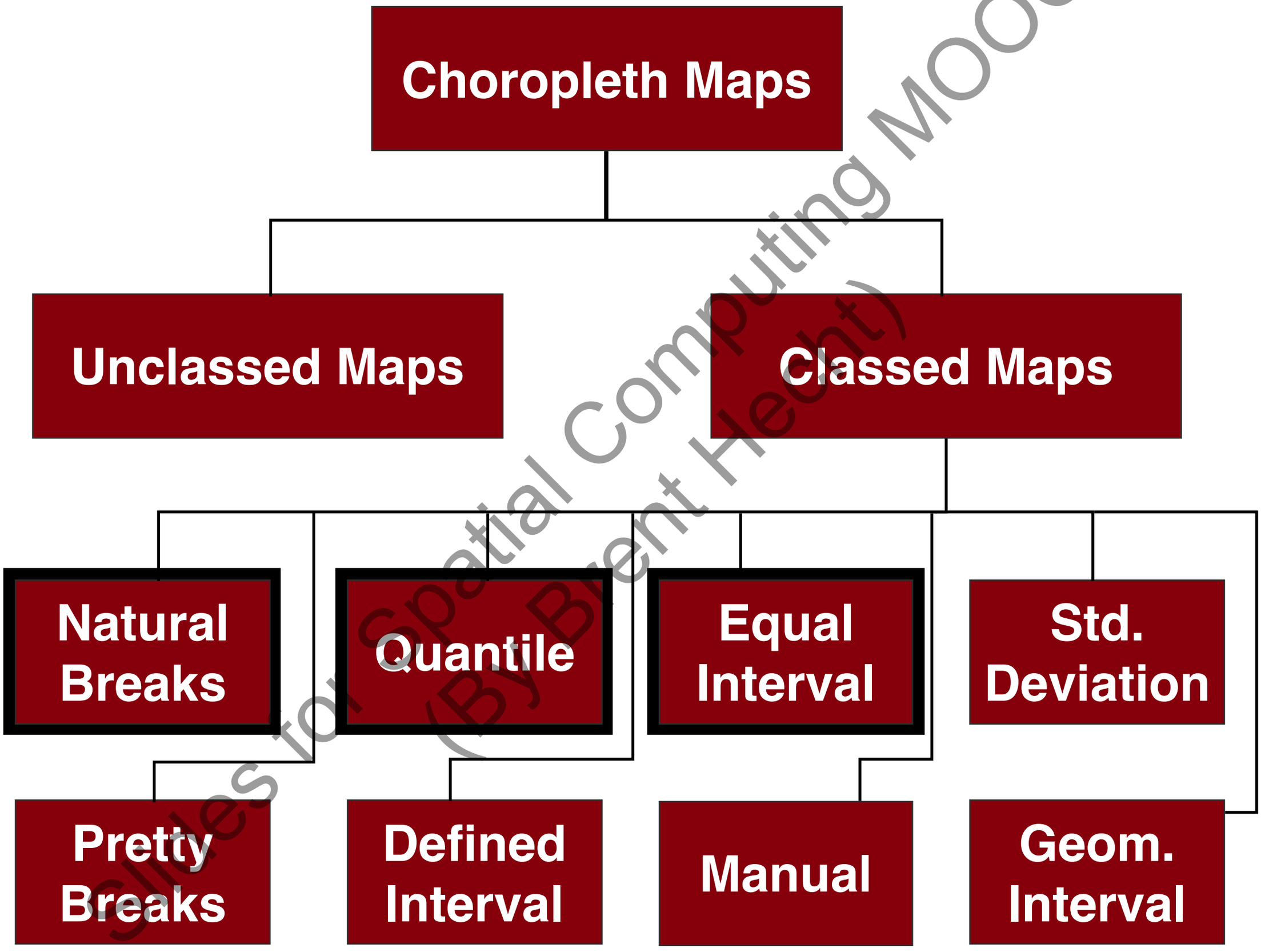
Limitations

There are at least three major drawbacks with unclassed choropleth maps. First, while the idea of letting our data speak for itself is appealing we often find it has too much to say. Cartographers have long relied on classification to suppress random noise or insignificant variations to highlight large, major differences. For example, a very simple 2-class map of unemployment (using only 2 colors) would quickly show whether a place is above or below the national average; More detail

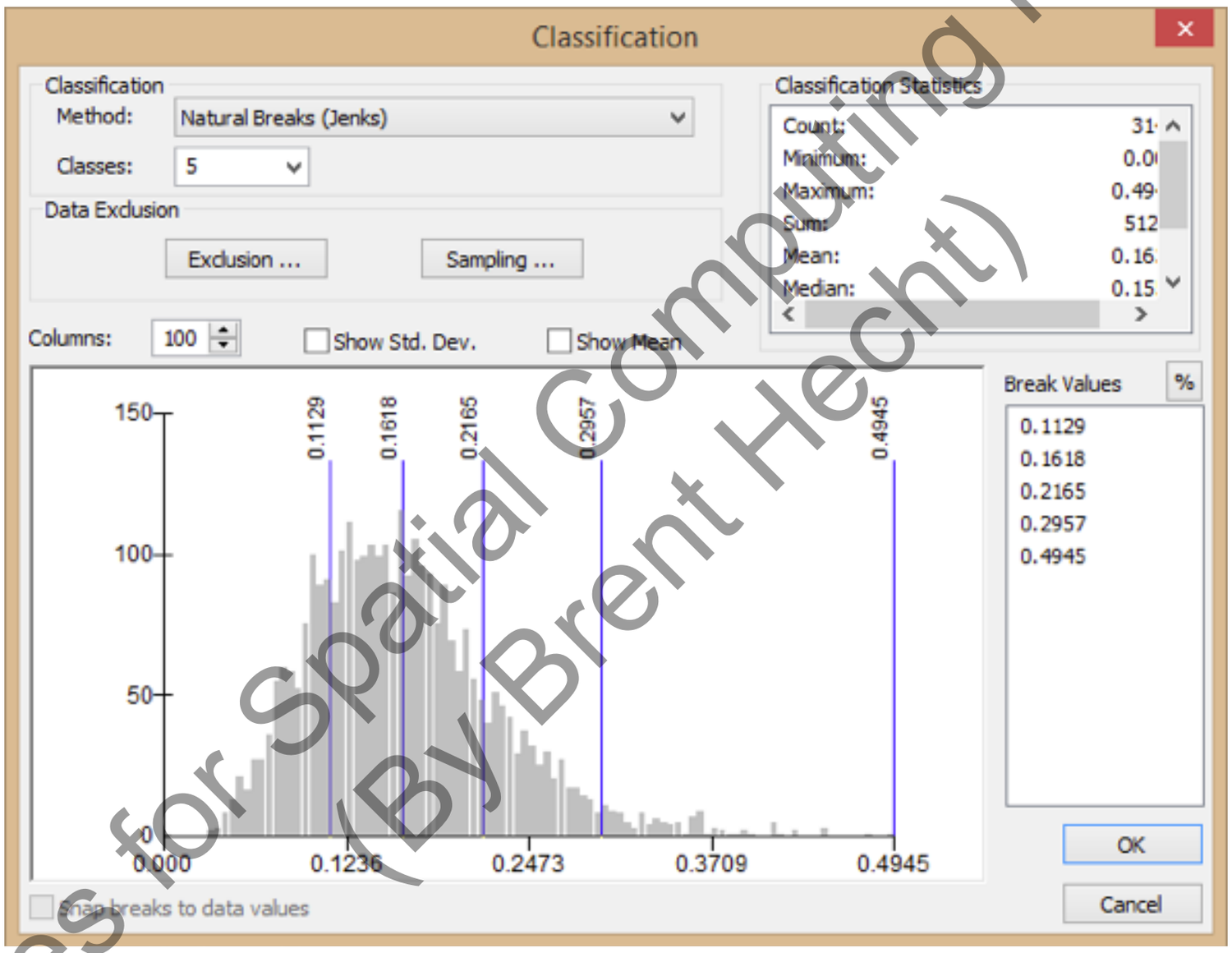
http://indiemapper.com/app/learnmore.php?l=choropleth

s that

are easily confused with each other. This makes it very hard to estimate values or get specific numbers from the map (e.g.,



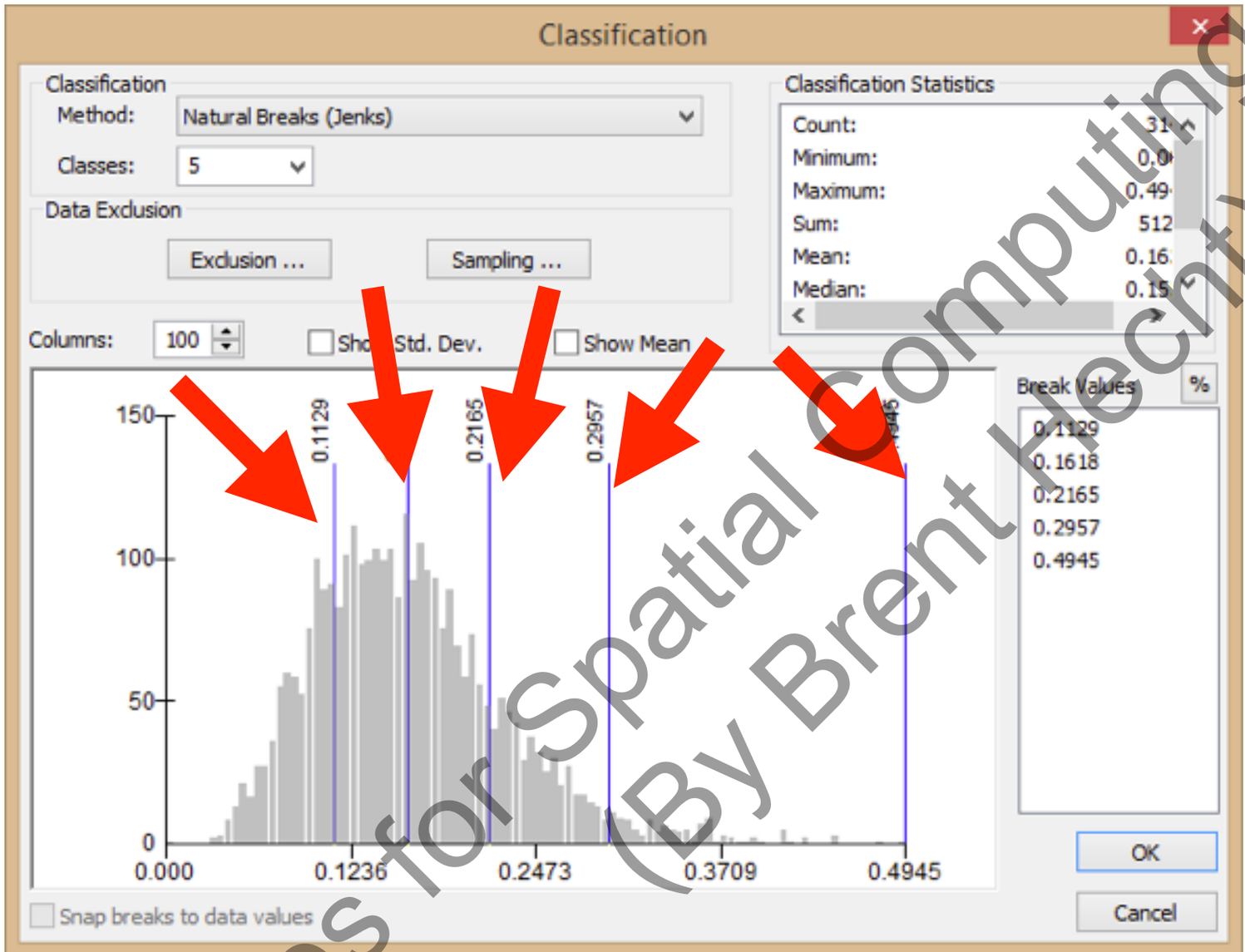
Natural Breaks Classification

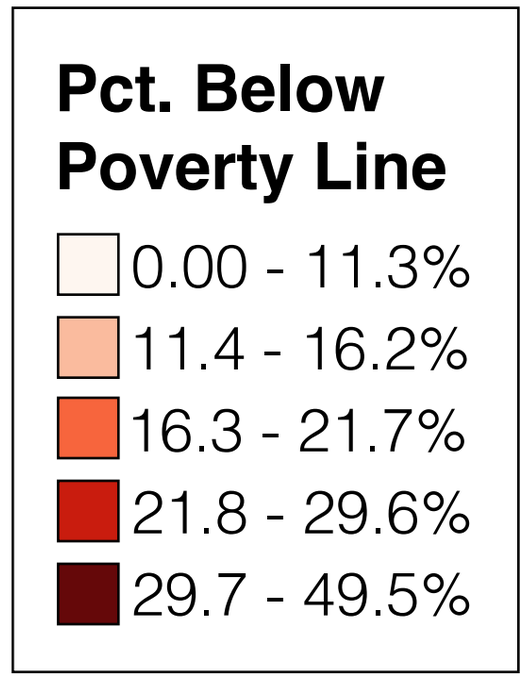


Pct. Below Poverty Line Attribute Value Distribution

Screenshot from ArcMap 10.2

Natural Breaks Classification

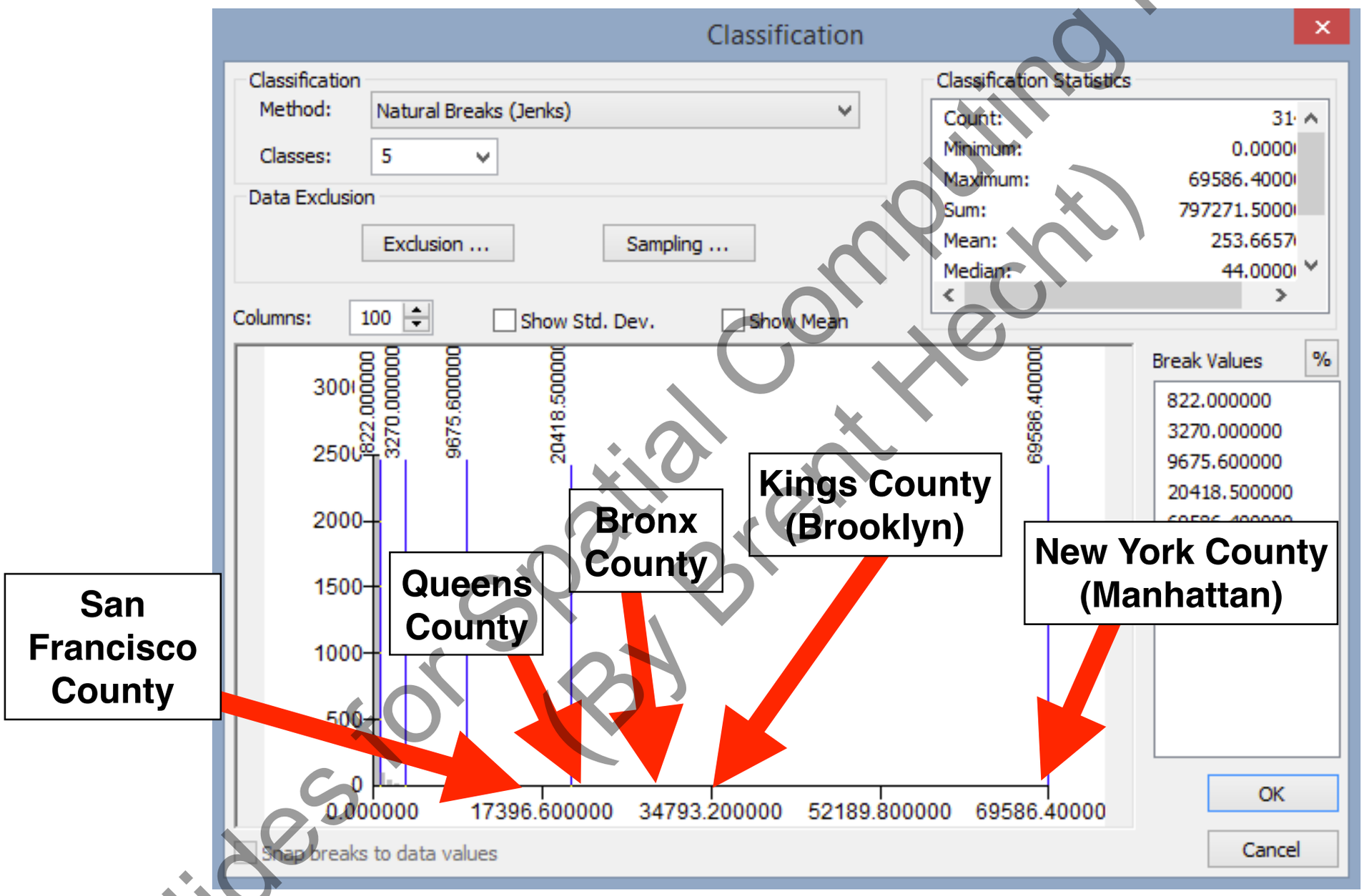




Pct. Below Poverty Line Attribute Value Distribution

Screenshot from ArcMap 10.2

Natural Breaks Classification

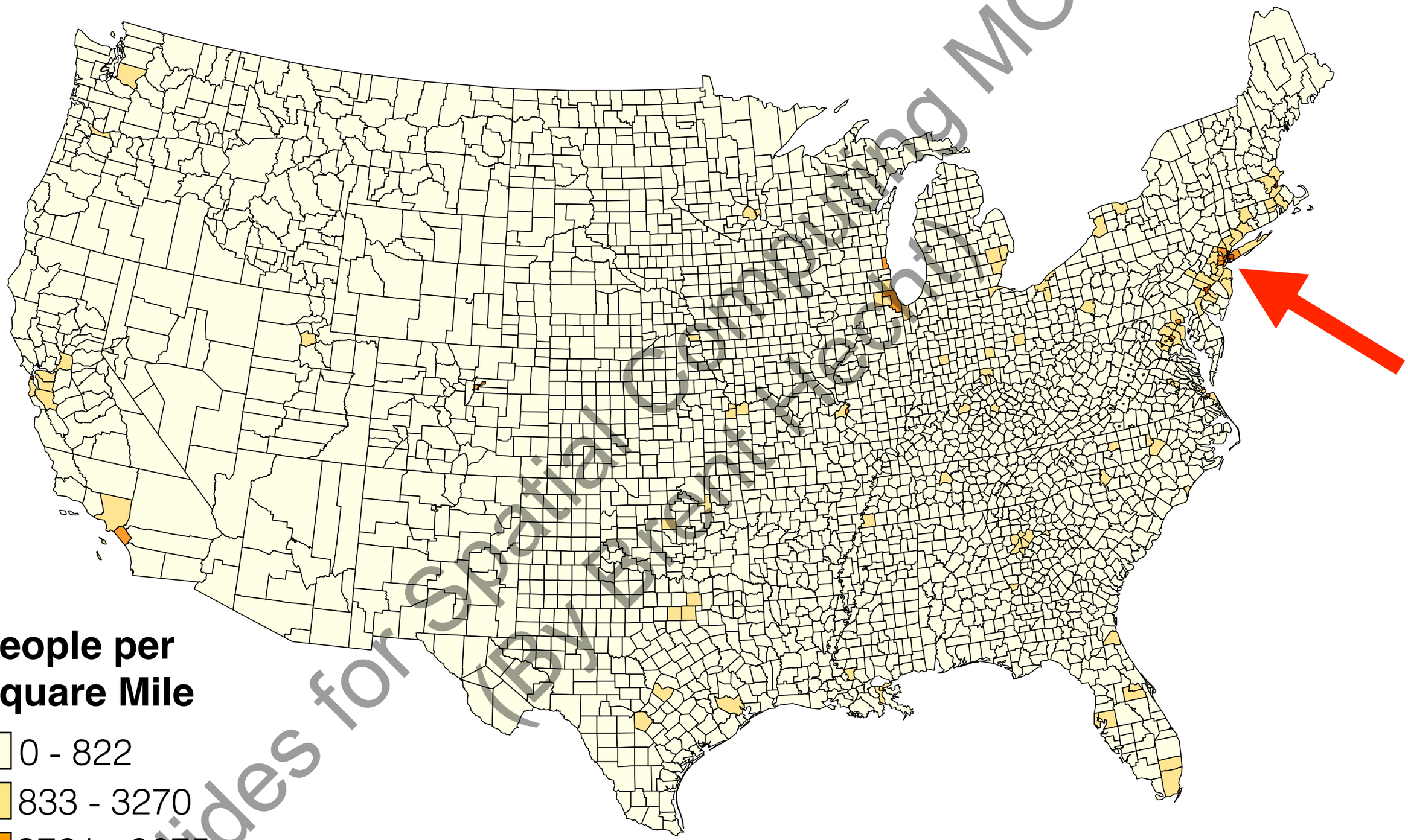


Population Density (People per Square Mile)

Screenshot from ArcMap 10.2

Population Density in the U.S.

People per Square Mile by County



People per Square Mile

- 0 - 822
- 833 - 3270
- 3721 - 9675
- 9676 - 20418
- 20419 - 69568

Data sources: U.S. Census, ESRI
Classification: Natural Breaks

Choropleth Maps

Unclassed Maps

Classed Maps

- Natural Breaks
- Quantile
- Equal Interval
- Std. Deviation
- Pretty Breaks
- Defined Interval
- Manual
- Geom. Interval

QuantileExample

QuantileExample

Columns (2/1)
- State Name
- Attribute Value

Rows

All rows	50
Selected	1
Excluded	0
Hidden	0
Labelled	0

	State Name	Attribute Value
1	Wyoming	0.628684744
2	Wisconsin	0.2816115406
3	West Virginia	0.2724013457
4	Washington	0.4908310038
5	Virginia	0.9769108994
6	Vermont	0.6578557848
7	Utah	0.3490212685
8	Texas	0.6763919496
9	Tennessee	0.9685244795
10	South Dakota	0.2681739626
11	South Carolina	0.7328552068
12	Rhode Island	0.522504366
13	Pennsylvania	0.3542625622
14	Oregon	0.3522289195
15	Oklahoma	0.6720866978
16	Ohio	0.3768142592
17	North Dakota	0.0045091594
18	North Carolina	0.3309581964
19	New York	0.1054128092
20	New Mexico	0.6218491374
21	New Jersey	0.5054483407
22	New Hampshire	0.0565240593
23	Nevada	0.3271966181
24	Nebraska	0.0646708442
25	Montana	0.6962972083
26	Missouri	0.0163905404
27	Mississippi	0.7700615935

Screenshot from JMP 11

QuantileExample

QuantileExample

Columns (2/1)
- State Name
- Attribute Value

Rows

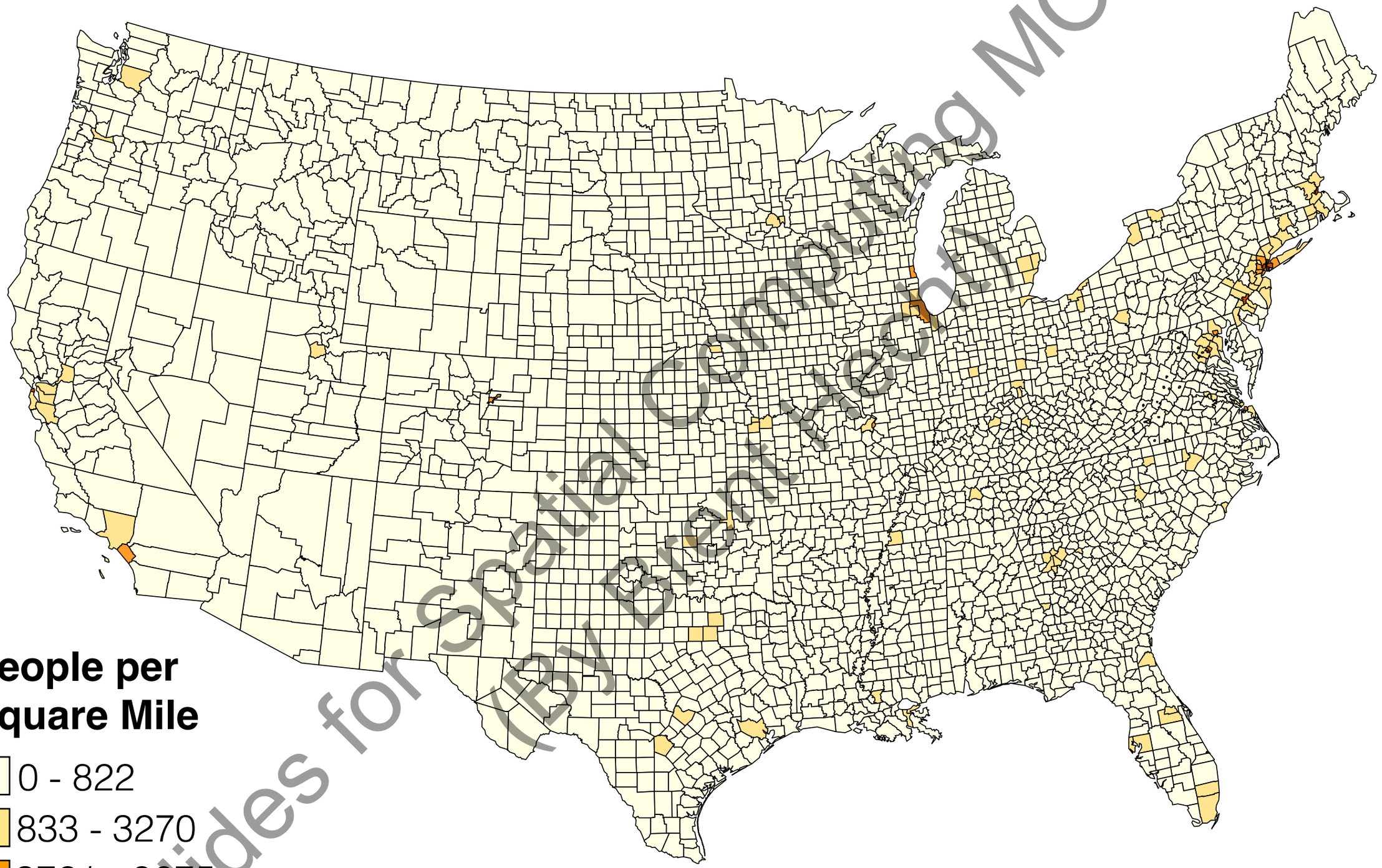
All rows	50
Selected	0
Excluded	0
Hidden	0
Labelled	0

	State Name	Attribute Value
1	Arizona	0.9852453978
2	Virginia	0.9769108994
3	Tennessee	0.9685244795
4	Alabama	0.9587183748
5	Arkansas	0.8629727496
6	Mississippi	0.7700615935
7	Minnesota	0.7410474042
8	Alaska	0.7367502658
9	South Carolina	0.7328552068
10	Iowa	0.7053067777
11	Montana	0.6962972083
12	Texas	0.6763919496
13	Delaware	0.6737801768
14	Oklahoma	0.6720866978
15	Vermont	0.6578557848
16	Louisiana	0.6430006351
17	Wyoming	0.628684744
18	New Mexico	0.6218491374
19	Georgia	0.5332210232
20	Rhode Island	0.522504366
21	New Jersey	0.5054483407
22	Washington	0.4908310038
23	Florida	0.4869914695
24	Kentucky	0.4696961681
25	Kansas	0.4348825025
26	Colorado	0.398861222
27	Connecticut	0.3847875695

Screenshot from JMP 11

Population Density in the U.S.

People per Square Mile by County



People per Square Mile

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Data sources: U.S. Census, ESRI
Classification: Natural Breaks

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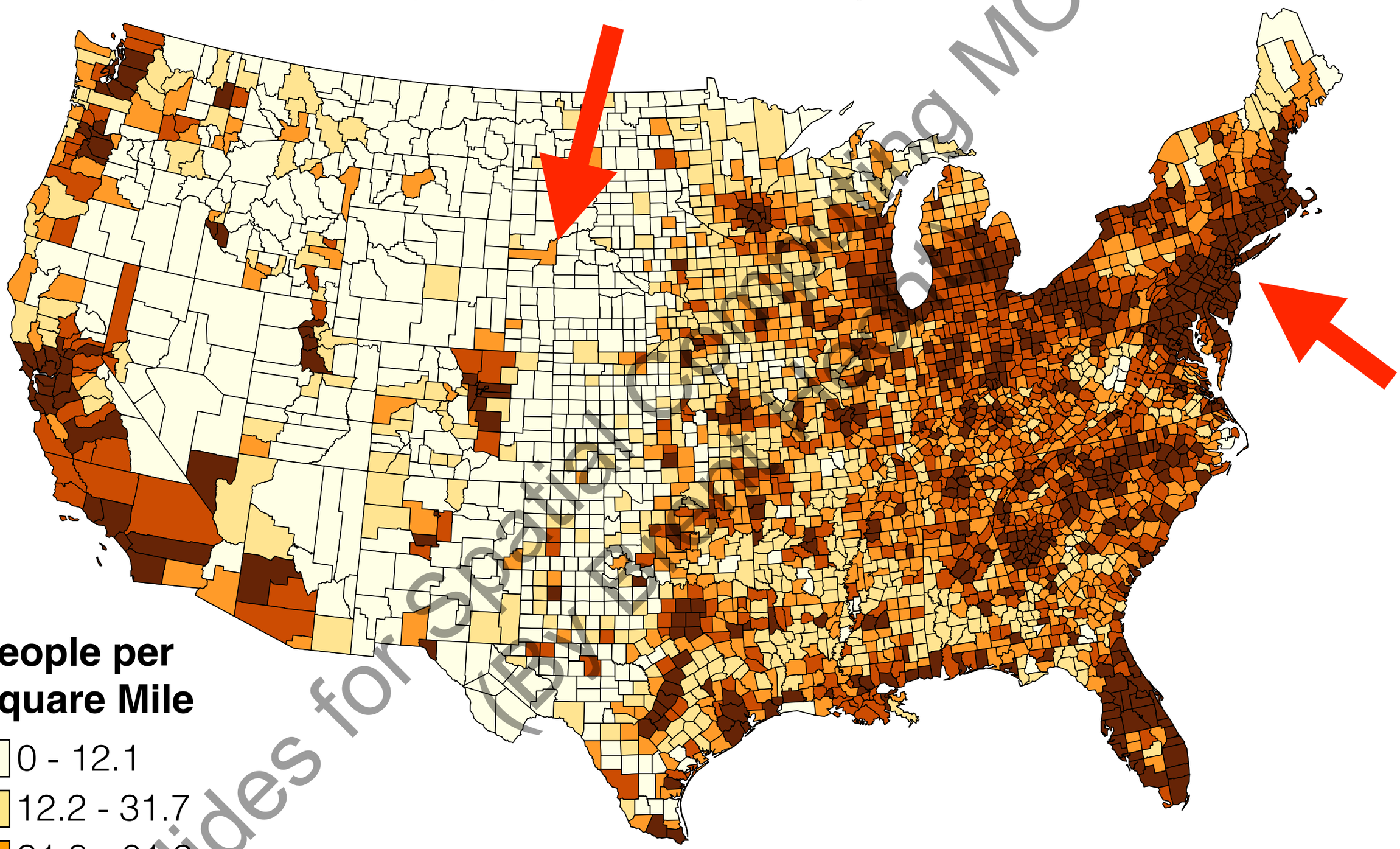


People per Square Mile

- 0 - 12.1
- 12.2 - 31.7
- 31.8 - 61.2
- 61.3 - 154.2
- 154.3 - 69586.4

Data sources: U.S. Census, ESRI
Classification: Natural Breaks

Choropleth Maps

Unclassed Maps

- Natural Breaks
- Quantile
- Pretty Breaks

Classed Maps

- Equal Interval
- Std. Deviation
- Defined Interval
- Manual
- Geom. Interval

Highest Attribute Value (e.g. Manhattan's population density)

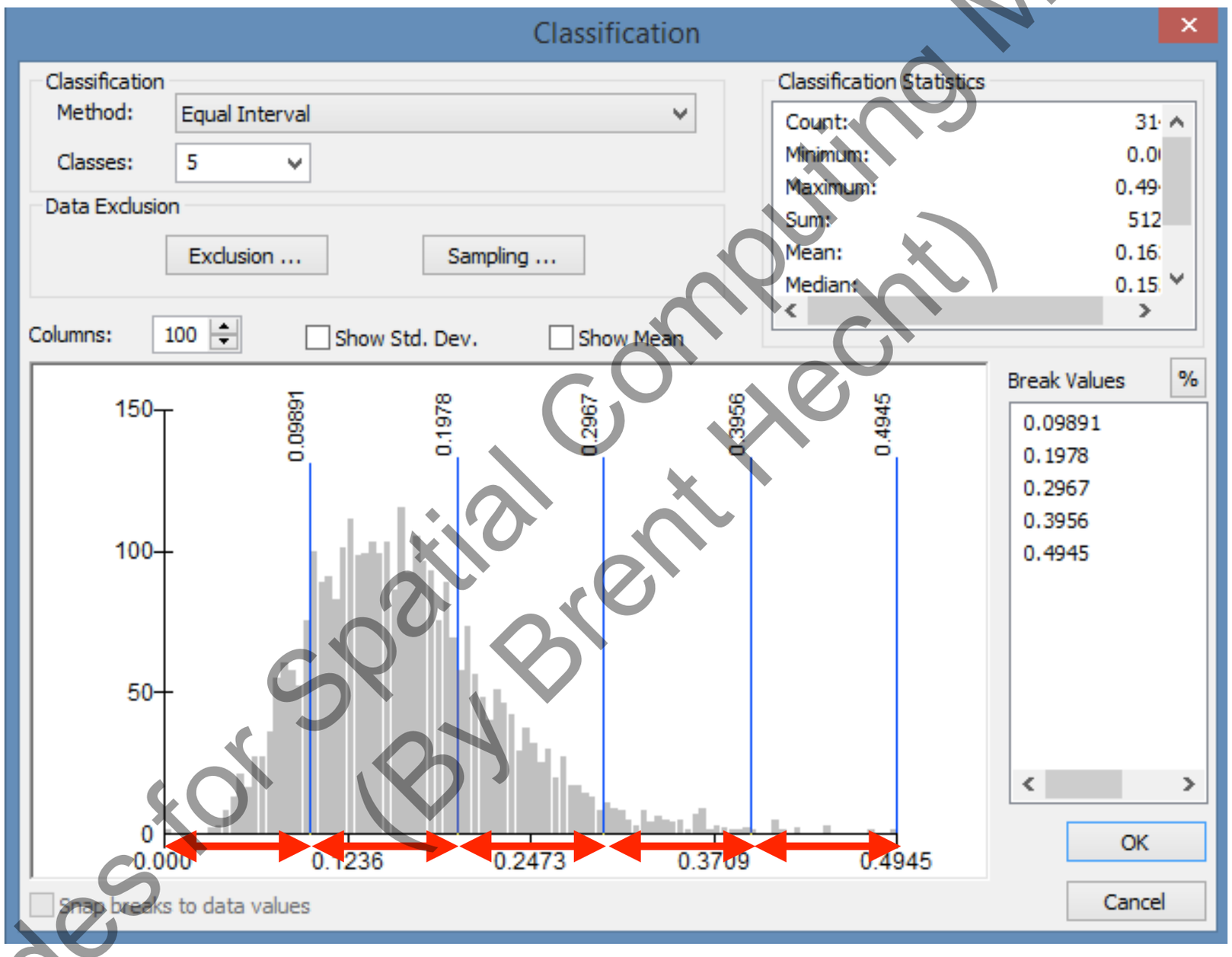
—

Lowest Attribute Value (e.g. Loving County, TX population density)

Number of **classes** (we've been using '5')

=

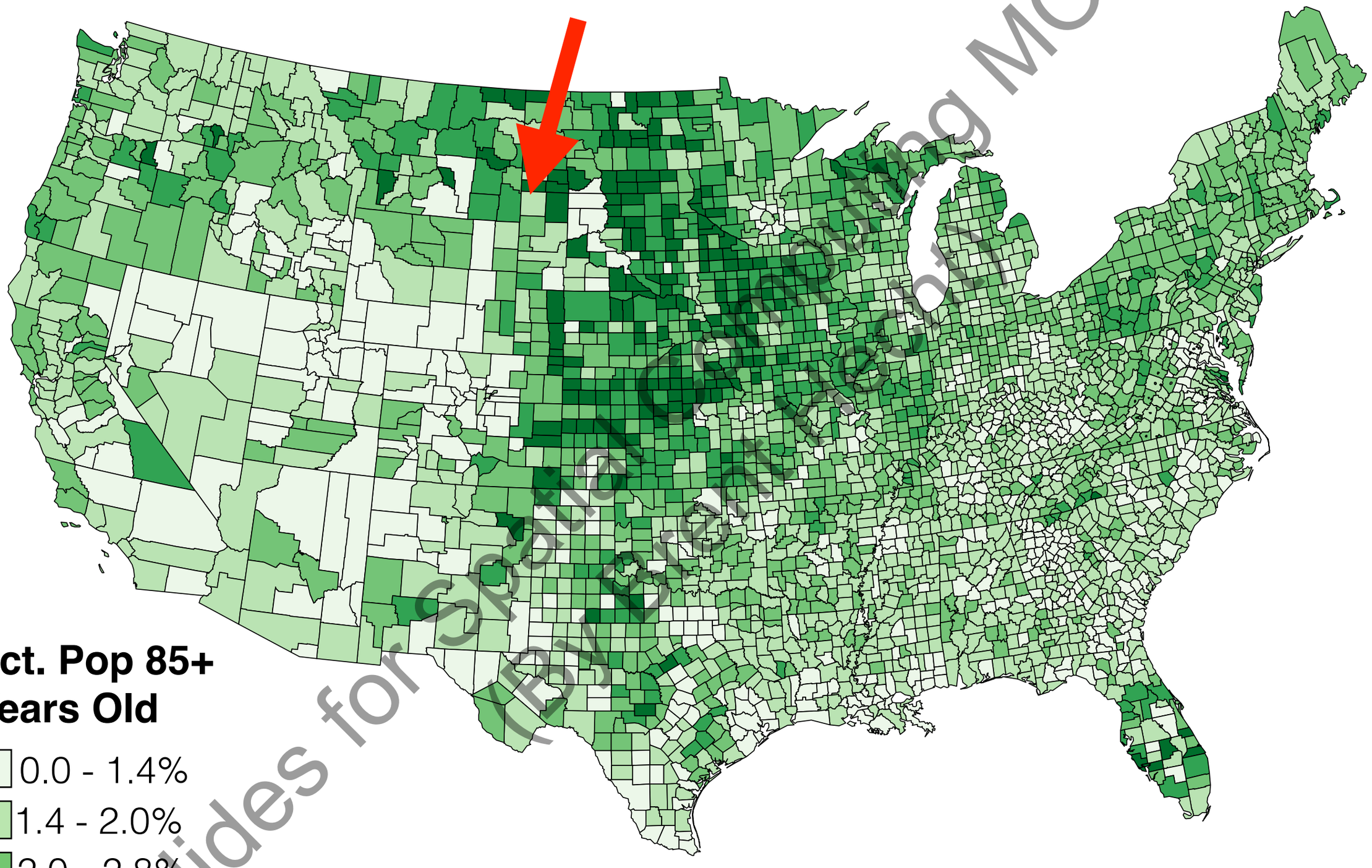
Class Width



Lying with maps!

85+ Population in the United States

Pct of the Population that is 85 Years Old or Older



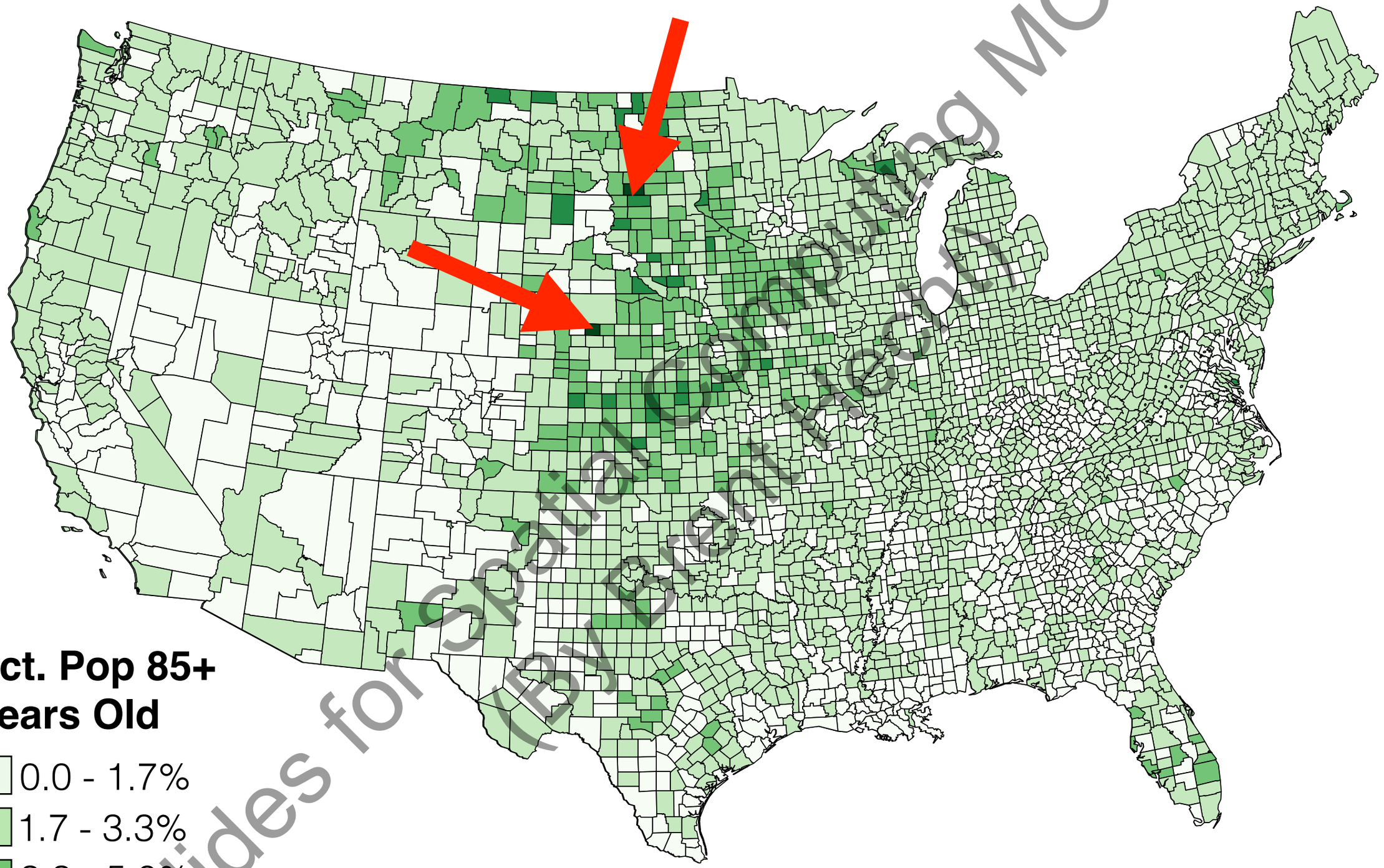
Pct. Pop 85+ Years Old

- 0.0 - 1.4%
- 1.4 - 2.0%
- 2.0 - 2.8%
- 2.8 - 3.9%
- 3.9 - 8.3%

Data sources: U.S. Census, ESRI
Classification: Natural Breaks

85+ Population in the United States

Pct of the Population that is 85 Years Old or Older



Pct. Pop 85+ Years Old

- 0.0 - 1.7%
- 1.7 - 3.3%
- 3.3 - 5.0%
- 5.0 - 6.6%
- 6.6 - 8.3%

Data sources: U.S. Census, ESRI
Classification: EQUAL INTERVAL

COLOR-related challenges when making **choropleth** maps:

1. Deciding on the set of colors you will use

2. Deciding how to assign colors to specific data values (data classification)

ColorBrewer: Color Advice for M…

colorbrewer2.org

Google

how to use | updates | downloads | credits

COLORBREWER 2.0
color advice for cartography

Number of data classes: 5

Nature of your data:
sequential diverging qualitative

Pick a color scheme:

Only show:
colorblind safe
print friendly
photocopy safe

Context:
roads
cities
borders

Background:
solid color
terrain

color transparency

5-class Accent

HEX

#7fc97f
#beaed4
#fdc086
#ffff99
#386cb0

EXPORT

http://www.colorbrewer.org

axismaps

http://www.wired.com/2014/10/cindy-brewer-map-design/

MapLab HERE BE DRAGONS

The Cartographer Who's Transforming Map Design

BY GREG MILLER 10.20.14 | 6:30 AM | PERMALINK

ColorBrewer: Color Advice for M…

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Google

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http://www.colorbrewer.org

axismaps

ColorBrewer: Color Advice for M…

colorbrewer2.org

Google

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Nature of your data:
sequential diverging qualitative

Pick a color scheme:
Multi-hue: Single hue:

Only show:
colorblind safe
print friendly
photocopy safe

Context:
roads
cities
borders

Background:
solid color
terrain

color transparency

5-class YlOrBr

HEX

#ffffd4
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#fe9929
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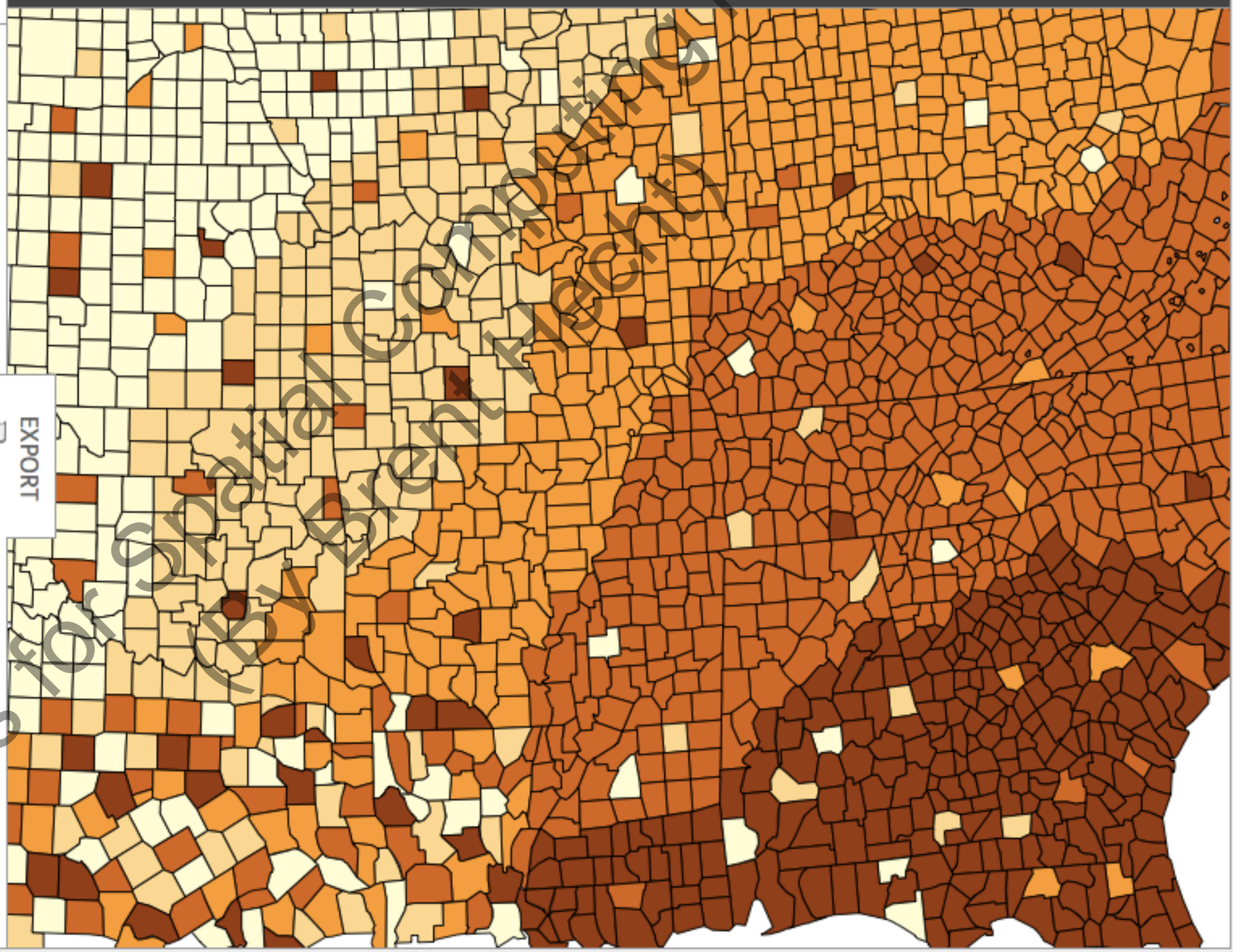
#993404

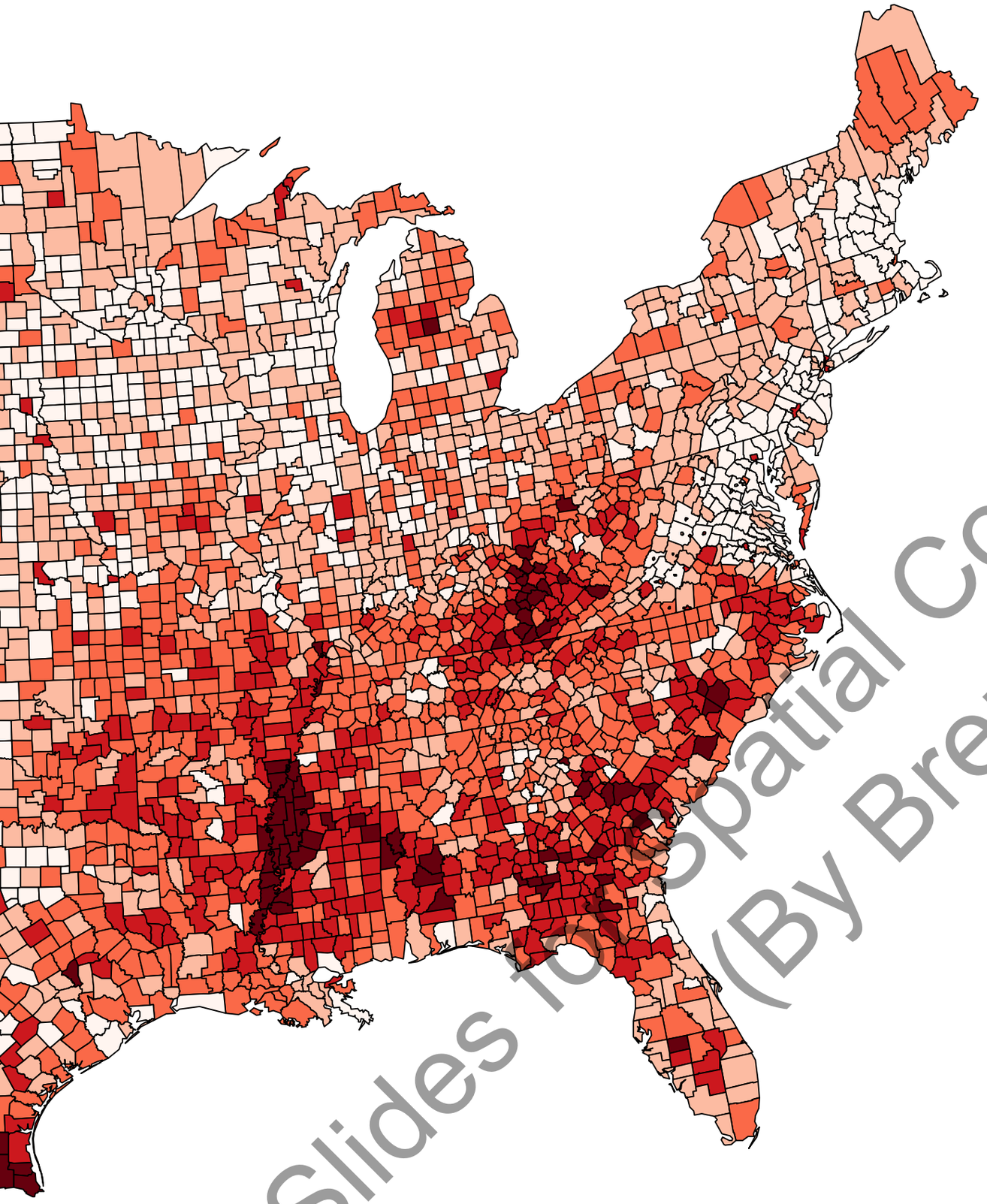
EXPORT

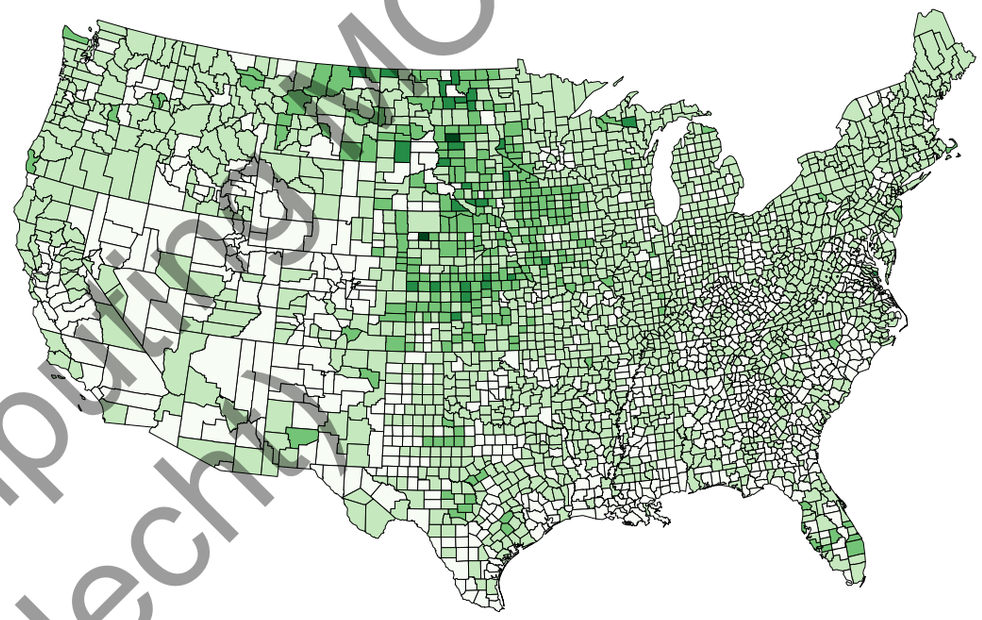
how to use | updates | downloads | credits

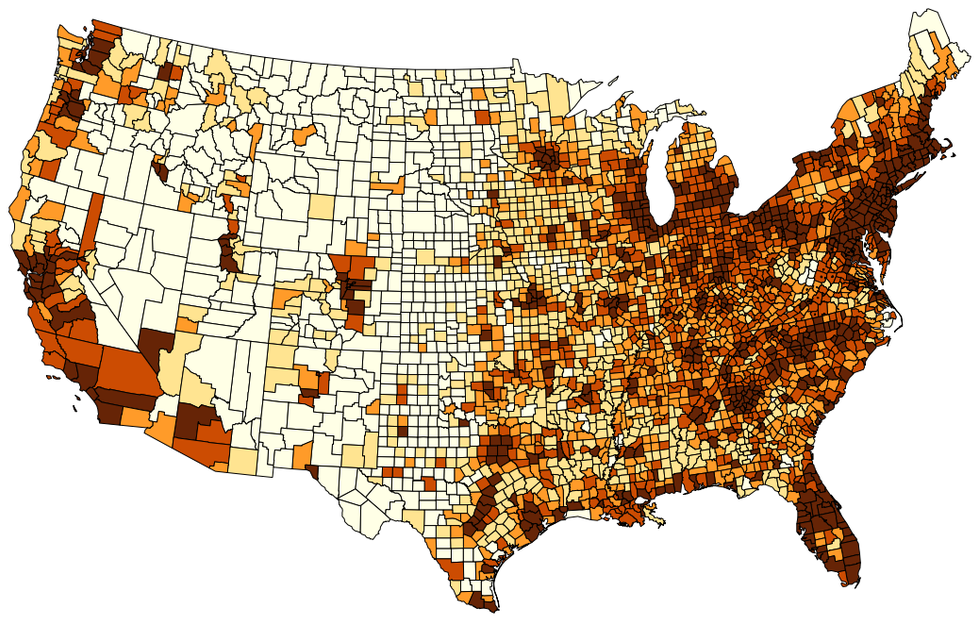
COLORBREWER 2.0
color advice for cartography



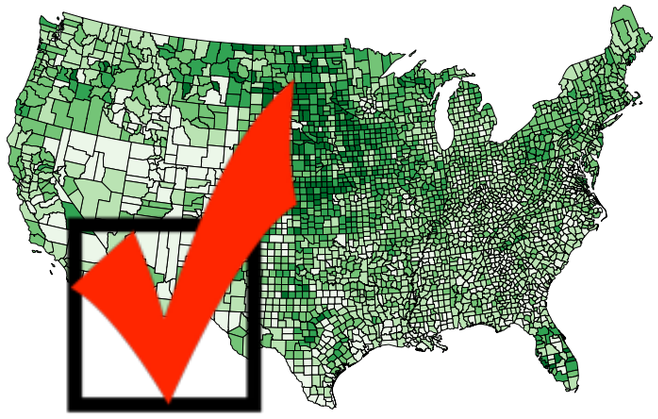
axismaps



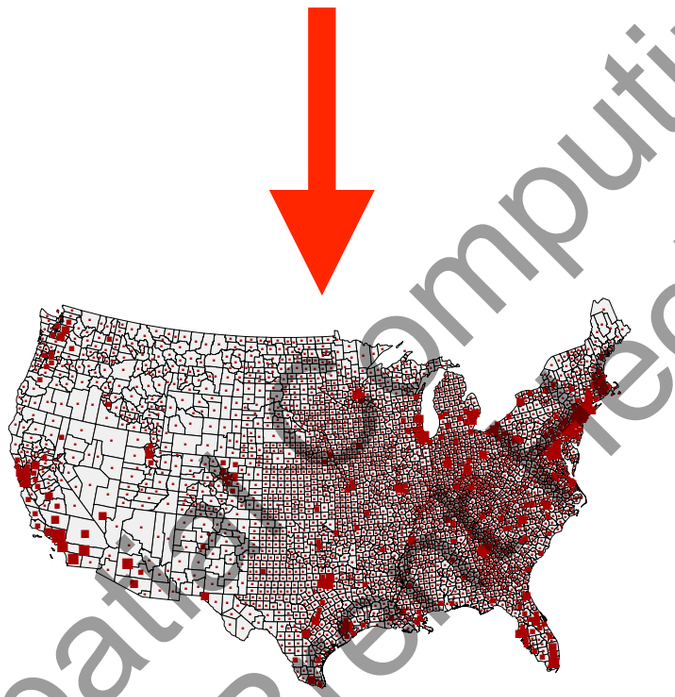




Types of thematic maps we're going to cover:



Choropleth

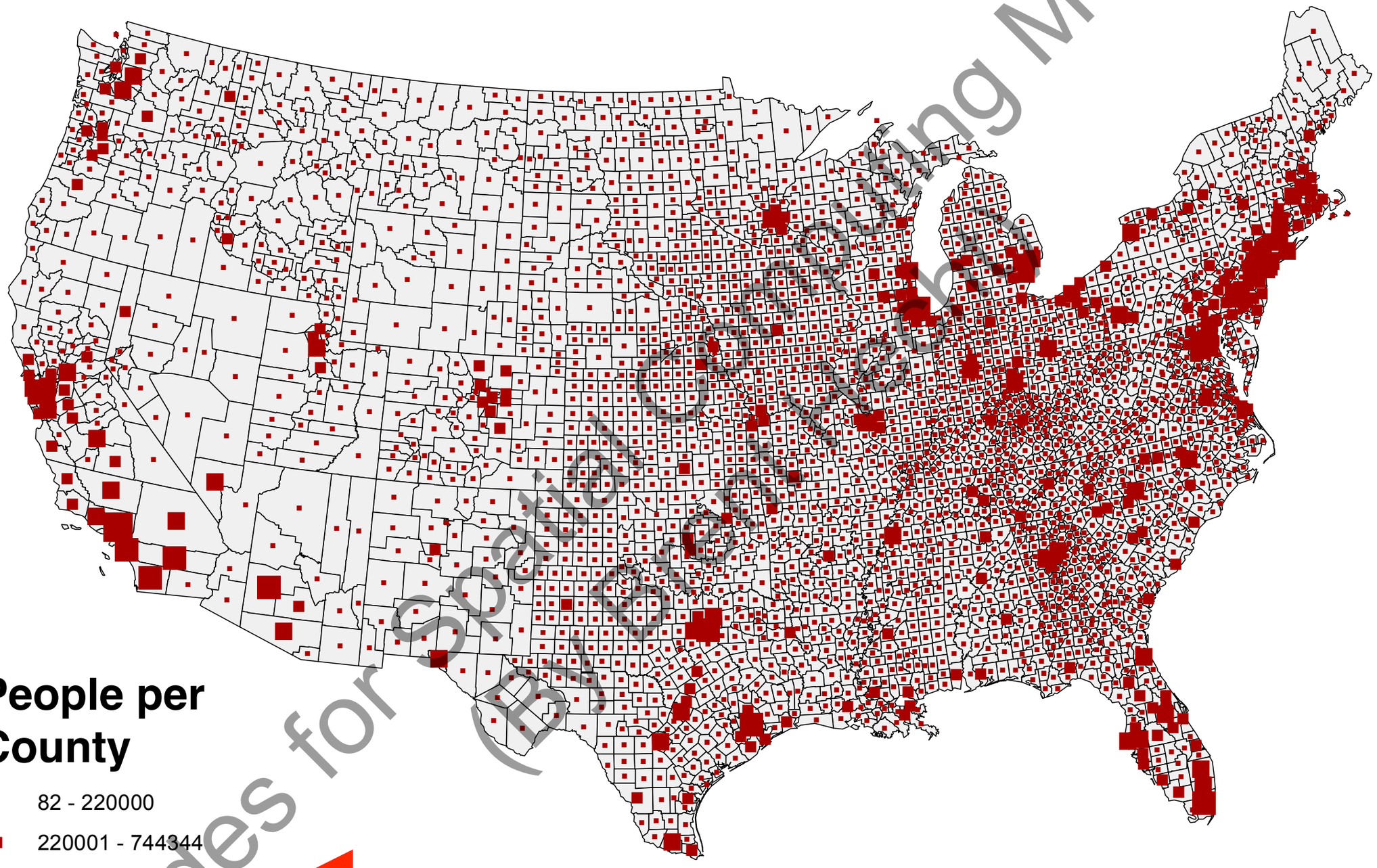


Graduated / Proportional Symbol

Cartograms

Population in the United States

Number of People per County



People per County

- 82 - 220000
- 220001 - 744344
- 744345 - 2035210
- 2035211 - 5194675
- 5194676 - 9818605

Data sources: U.S. Census, ESRI
Classification: Natural Breaks

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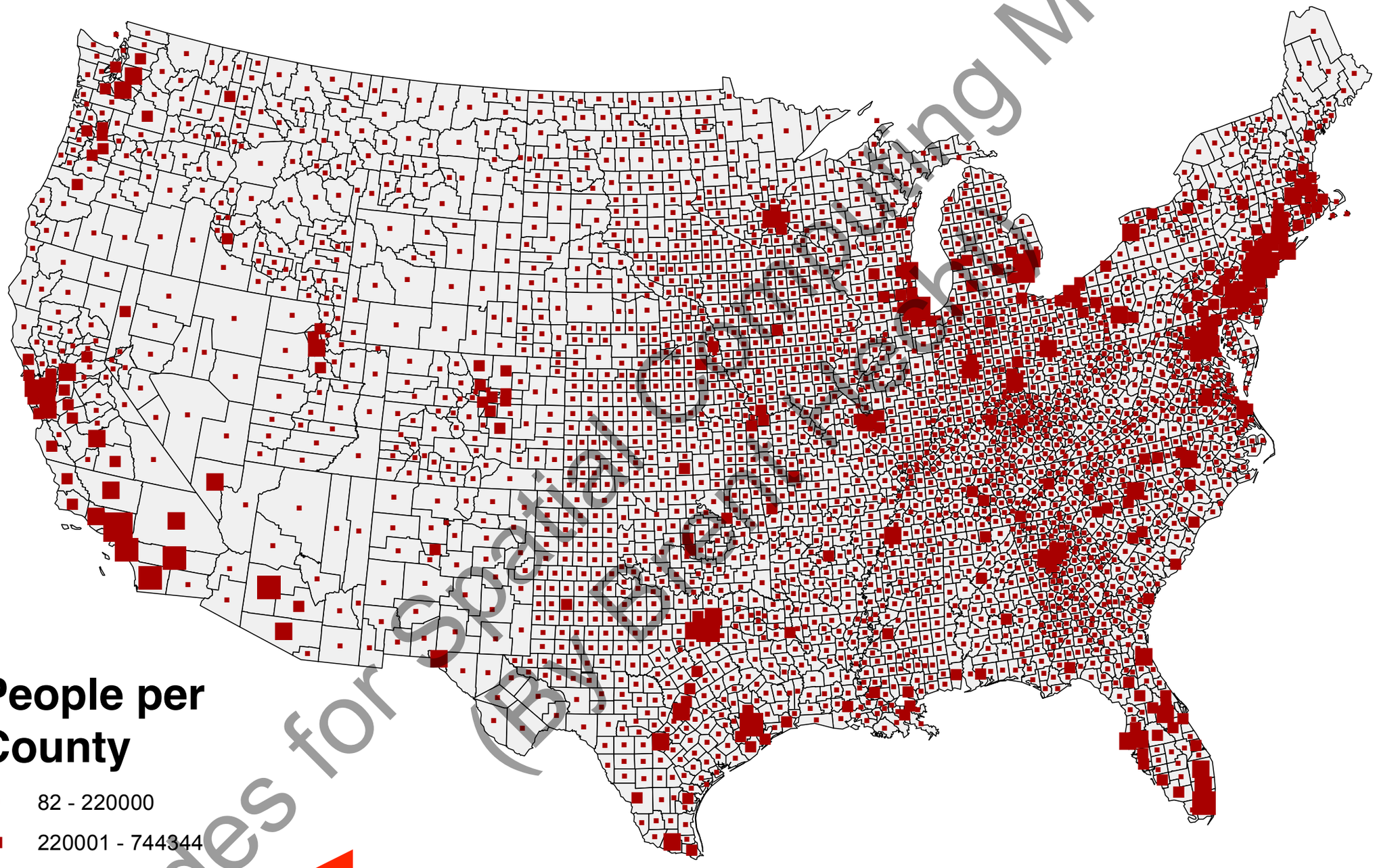

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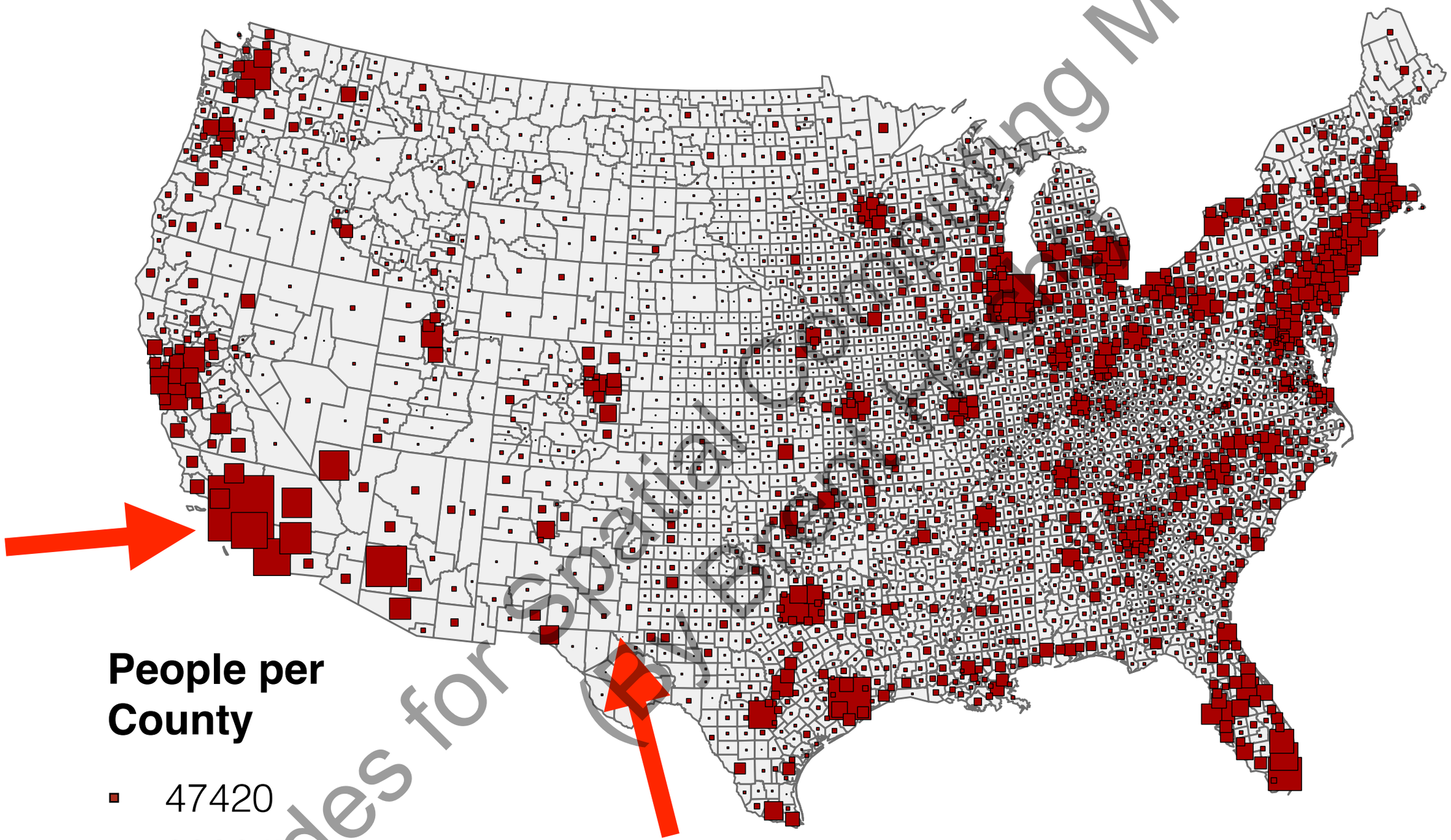


Data sources: U.S. Census, ESRI
Classification: Natural Breaks

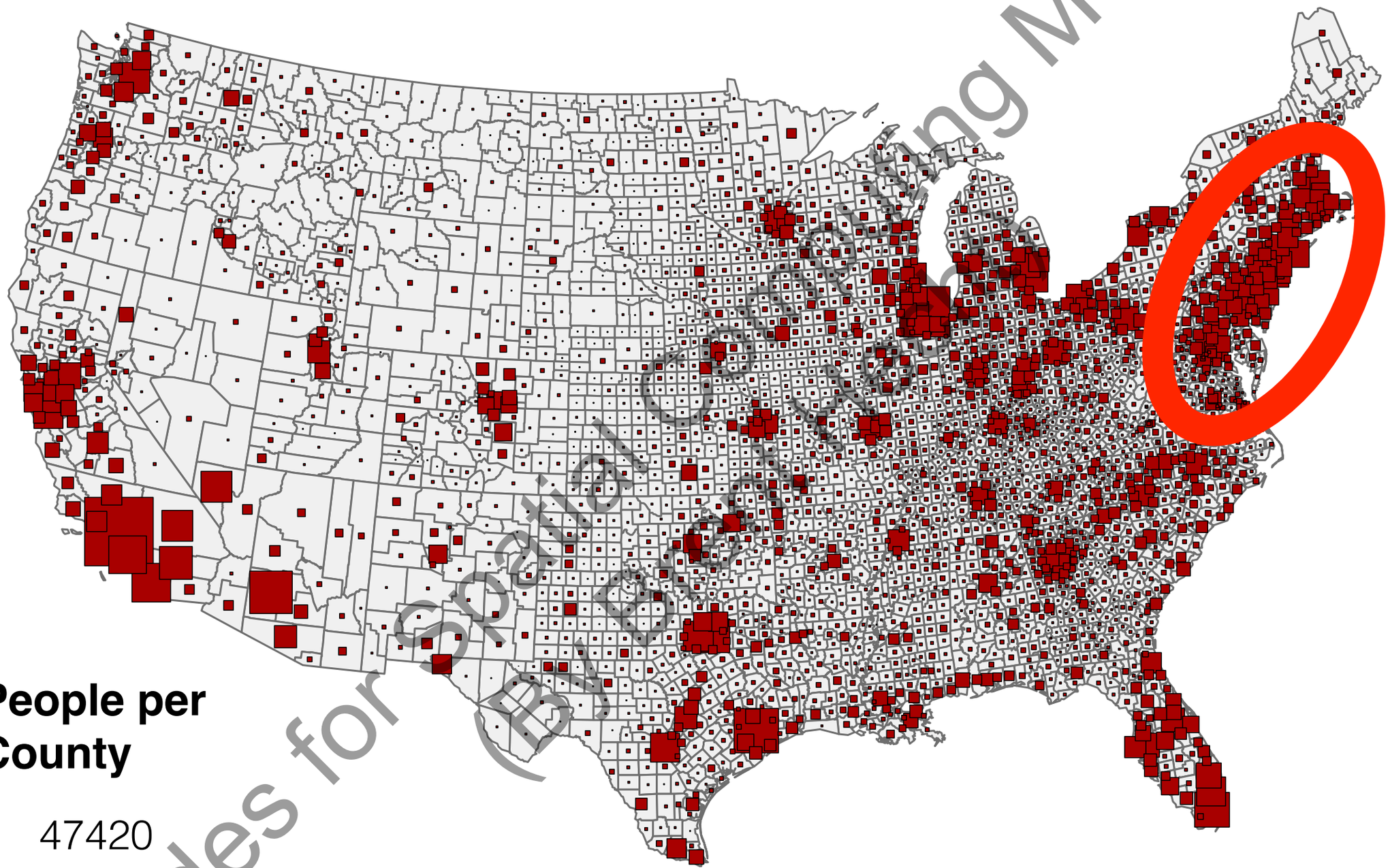
Pros and **cons** of **graduated/proportional** maps relative to **choropleth** maps:

Pro: Differences in size may be better than differences in color for some purposes

Con: Symbols overlap

Population in the United States

Number of People per County



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Pros and **cons** of **graduated/proportional** maps relative to **choropleth** maps:

Pro: Differences in size may be better than differences in color for some purposes

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Con: Confusing to use size for percentages, densities, etc.

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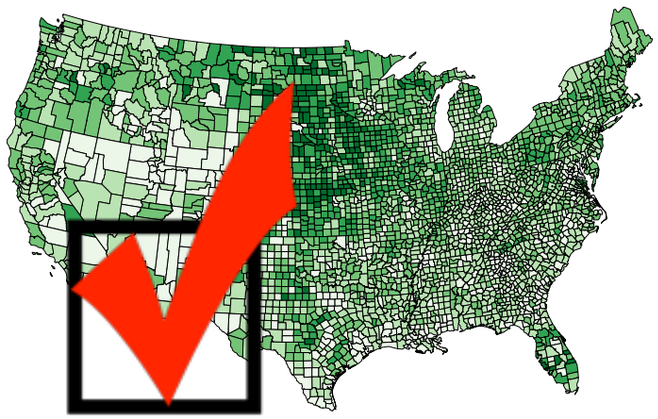
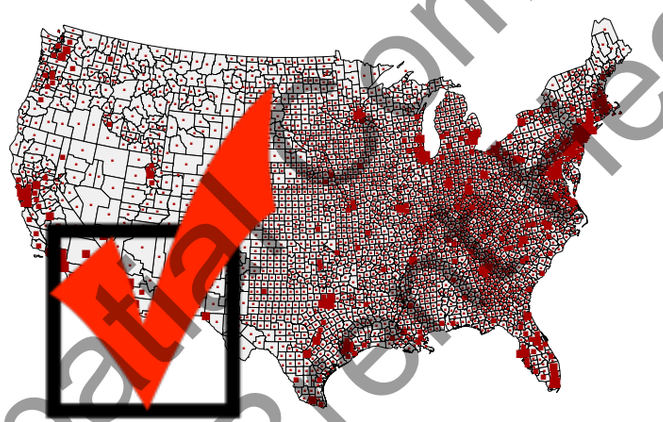
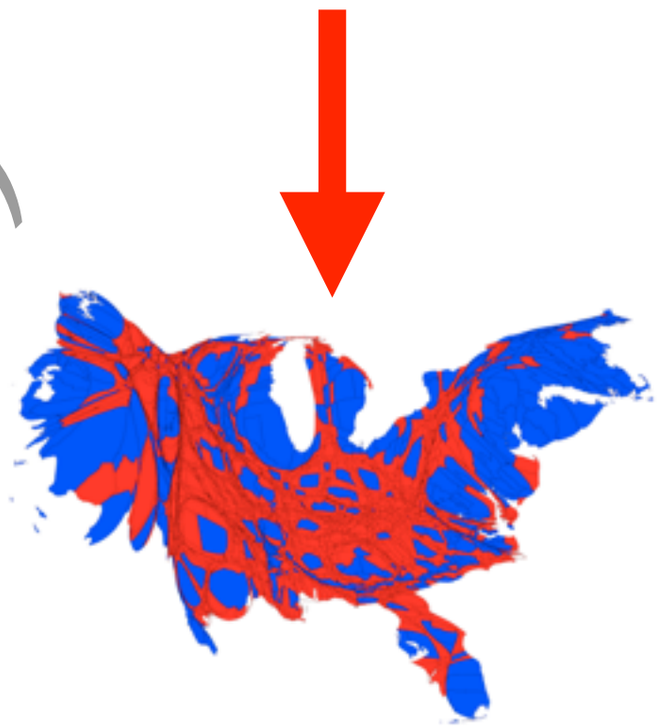


Choropleth

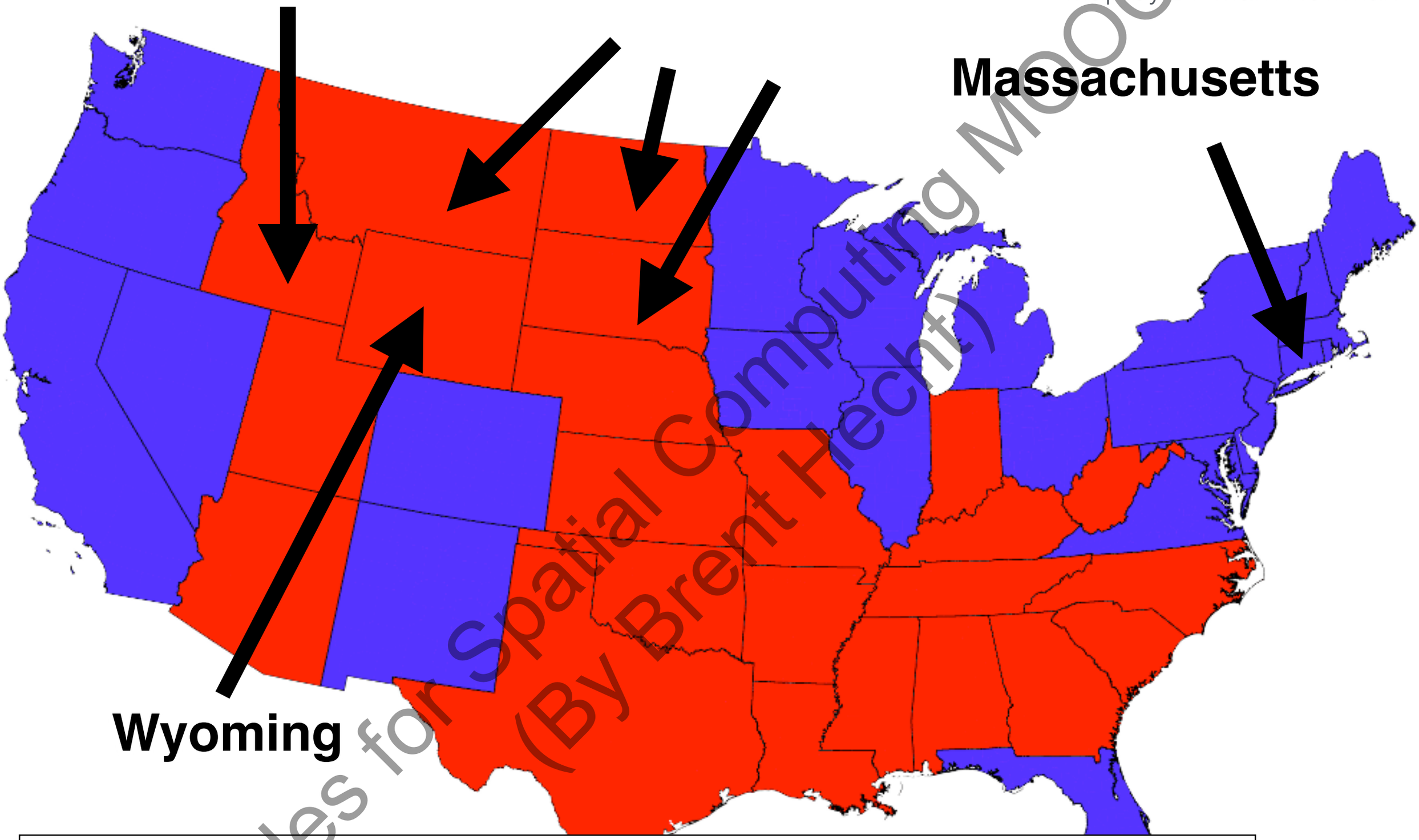


Graduated / Proportional Symbol

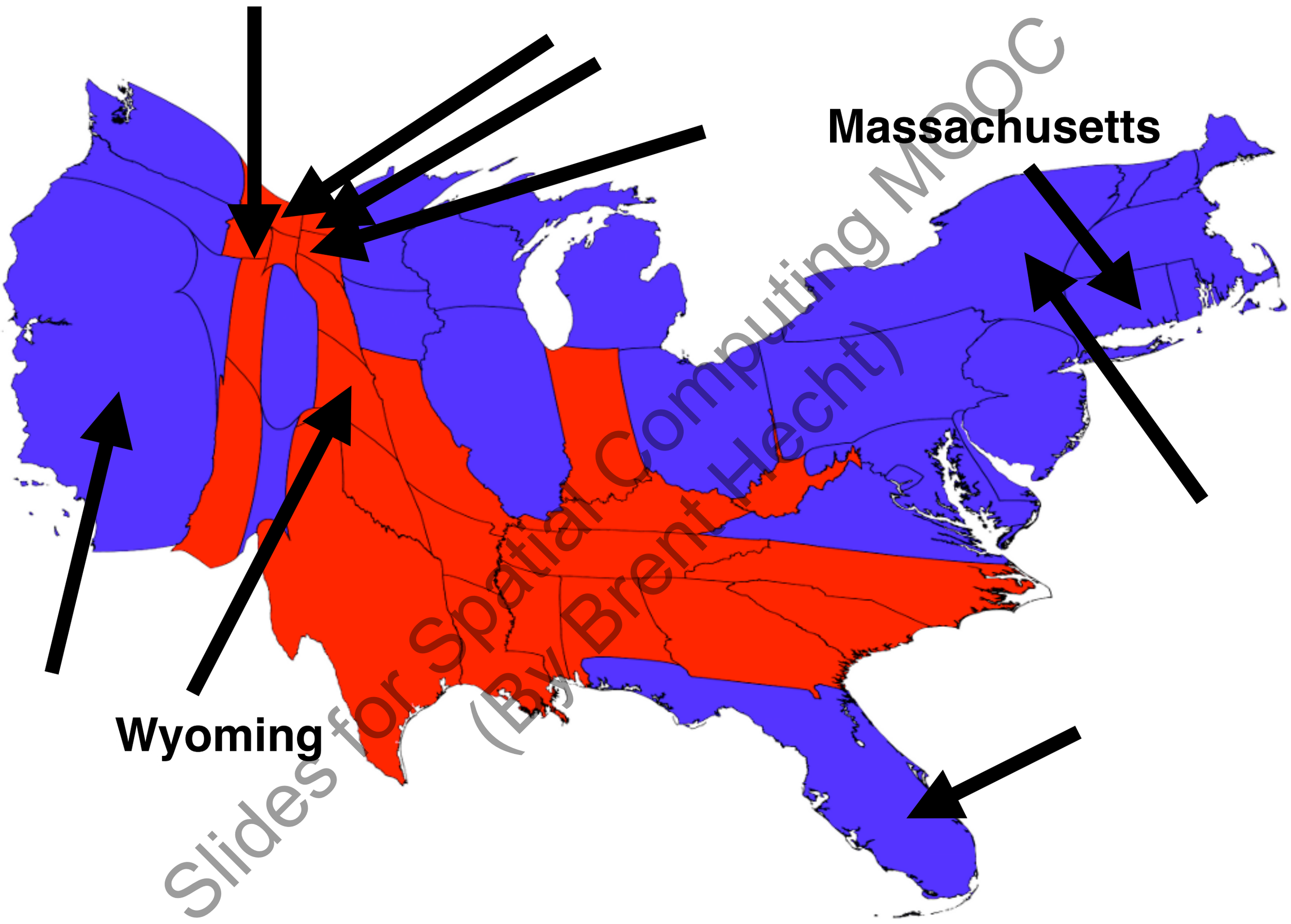


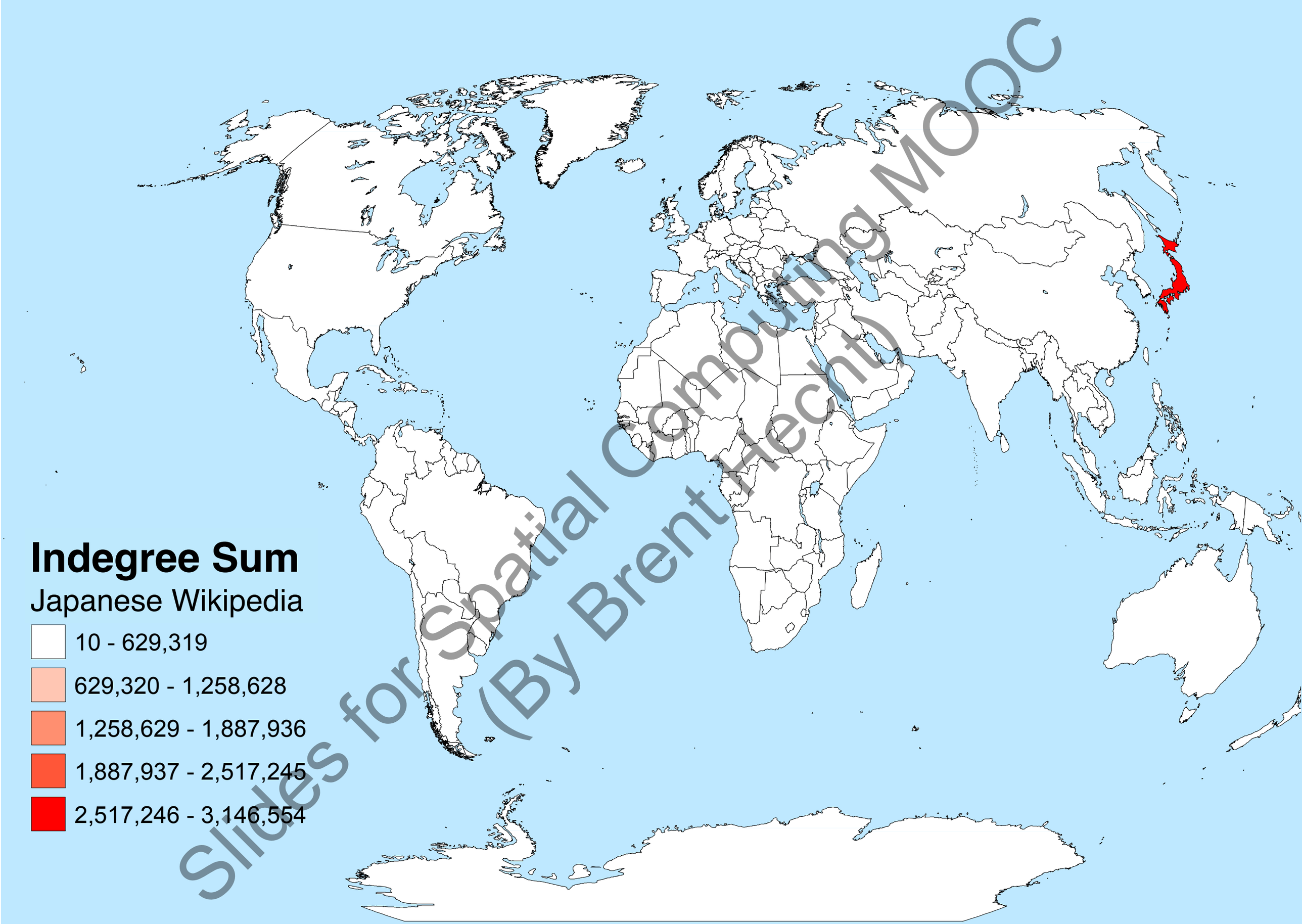
Cartograms

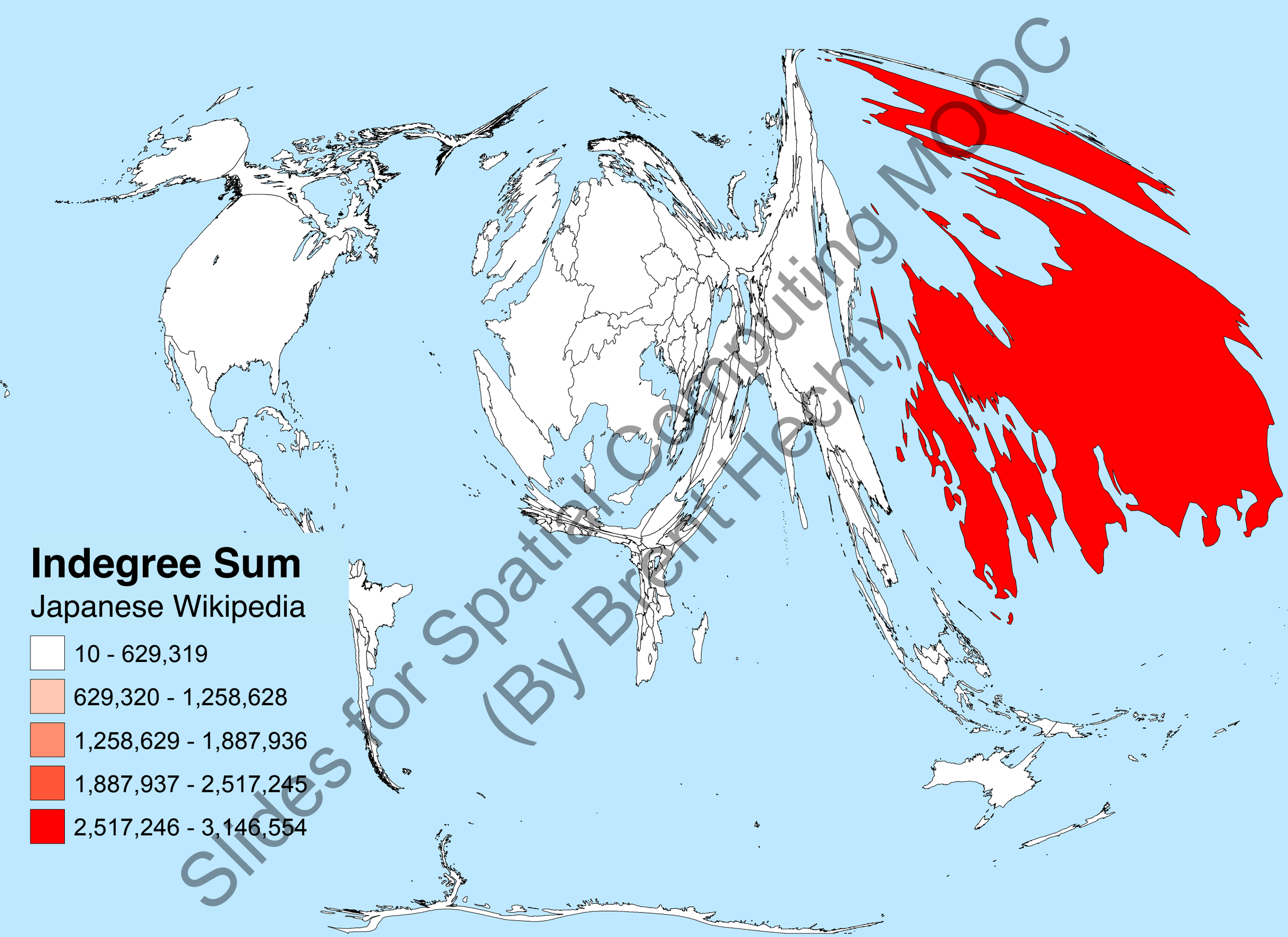
Map by Dr. Mark Newman



http://www-personal.umich.edu/~mejn/election/2012/statemap1024.png







The Electoral Map: Building a Path to Victory

A New York Times assessment of how states may vote, based on polling, previous election results and the political geography in each state.

Obama ELECTORAL VOTES **243** Needs 27 to win

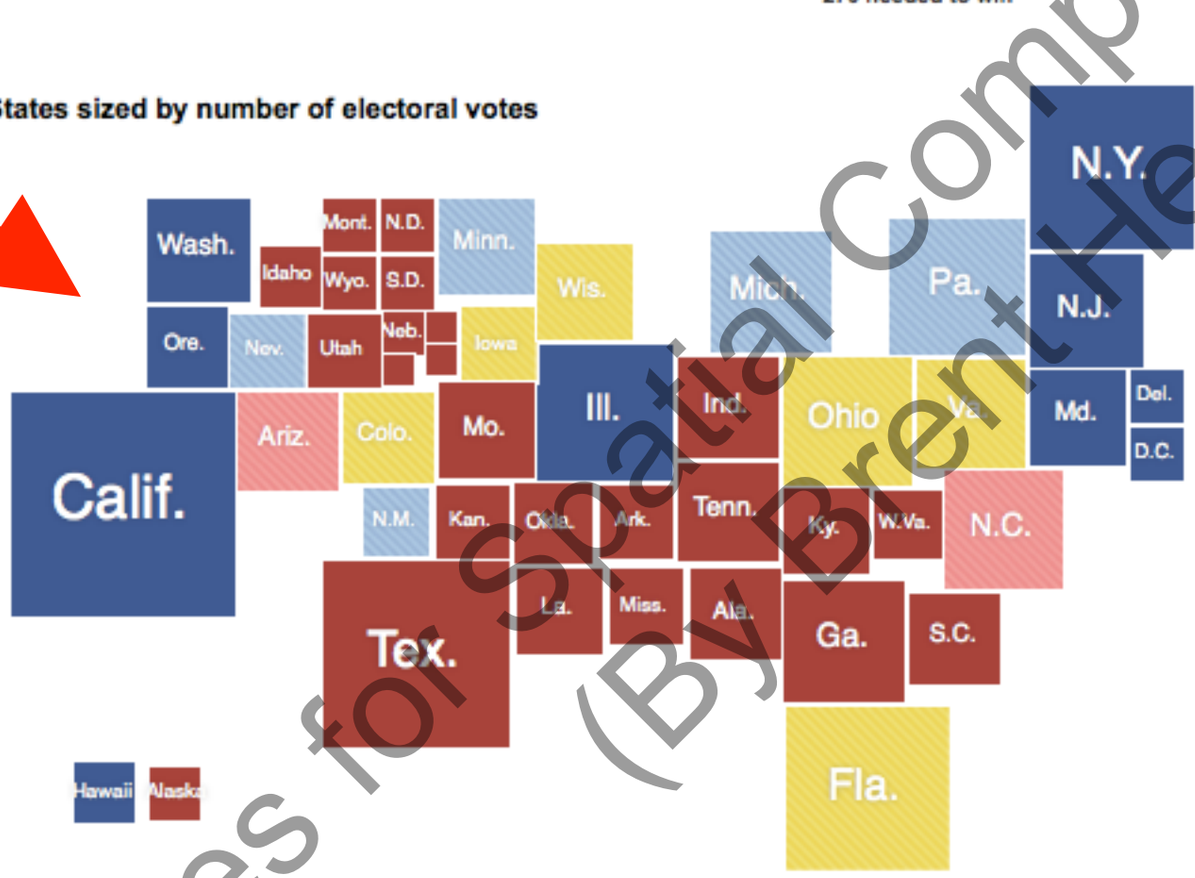
206 Needs 64 to win **Romney** ELECTORAL VOTES

185 Solid Obama | 58 Leaning Ob… | 89 Tossup Votes | 26 L… | 180 Solid Romney

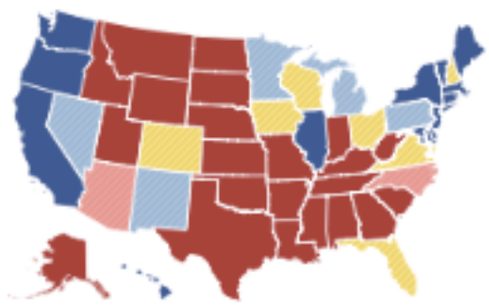
270 needed to win

Maine and Nebraska give two electoral votes to the statewide winner and allocate the rest by congressional district.

States sized by number of electoral votes



Geographic View



Leaning Democratic (6)

Maine

Maine has largely slipped from the ranks of top battleground states, with Democrats winning here in the last five presidential elections. The

Tossup (7)

Colorado

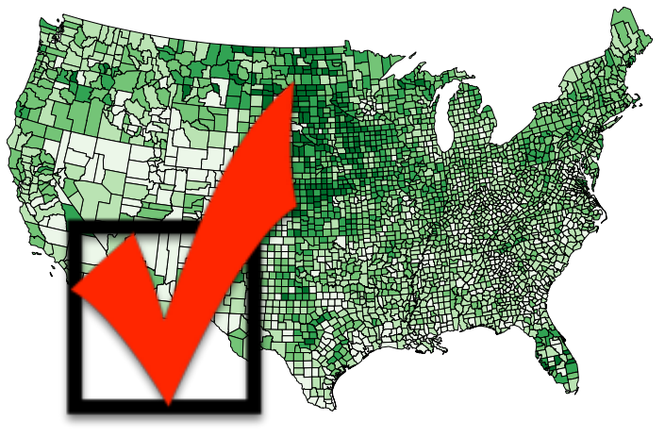
President Obama's victory in Colorado was among his most prized accomplishments in 2008, after the state had voted reliably

Leaning Republican (2)

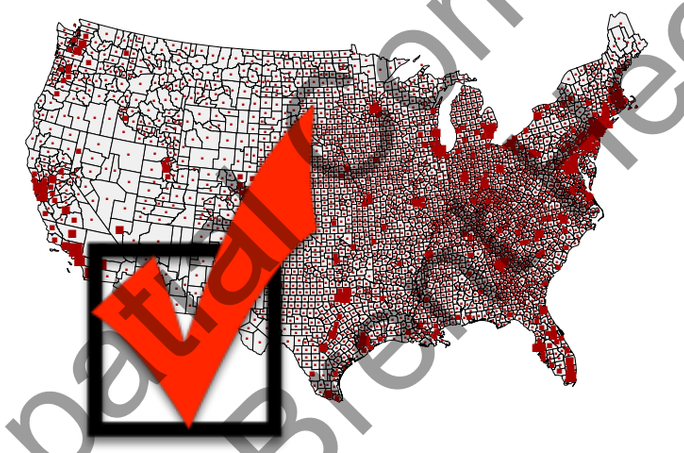
Arizona

The politics of Arizona are gradually shifting with its demographics. For now, Republicans believe their party has an advantage in presidential

Types of thematic maps we're going to cover:



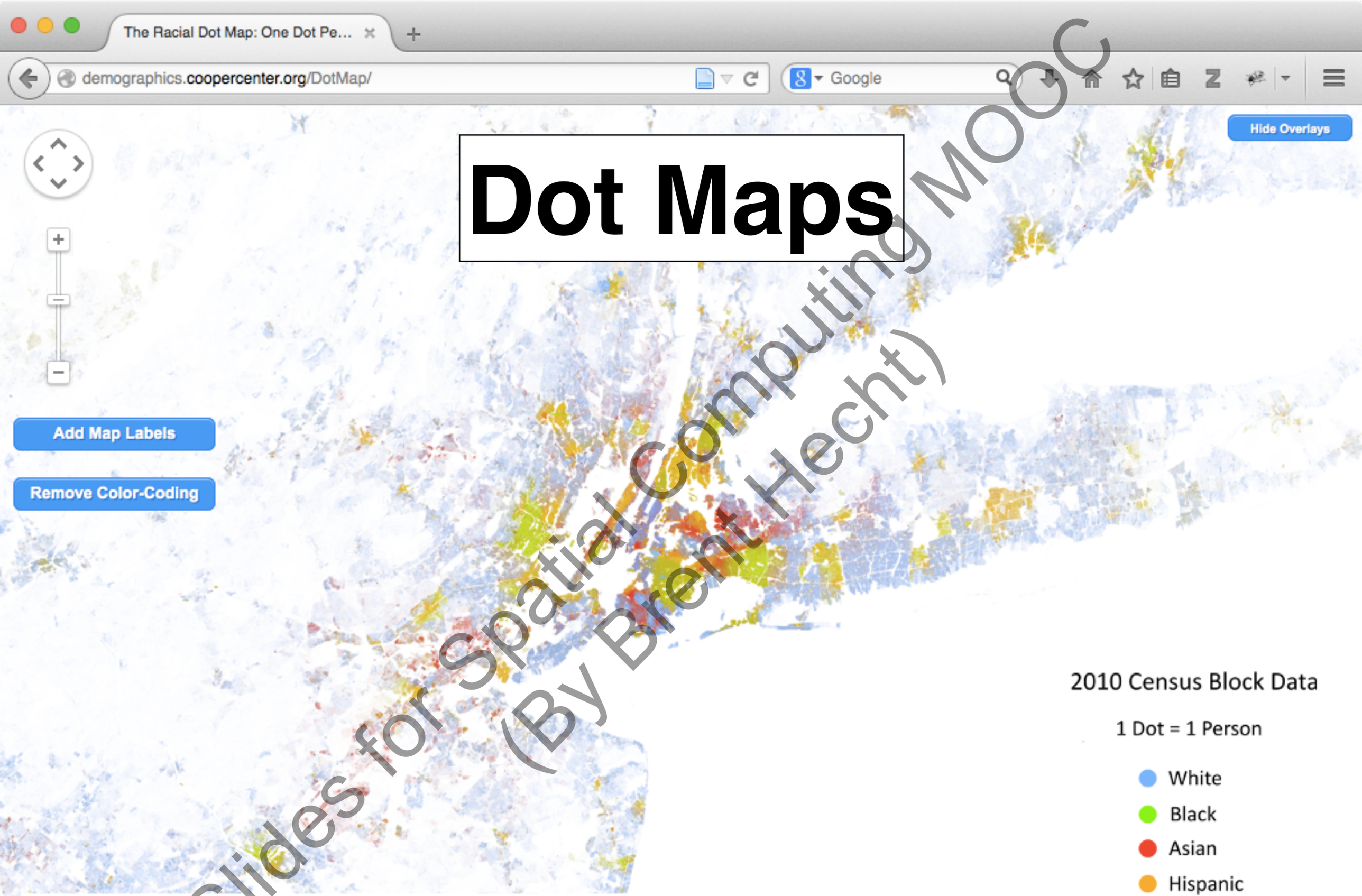
Choropleth



Graduated / Proportional Symbol

Cartograms

Dot Maps



http://demographics.coopercenter.org/DotMap/

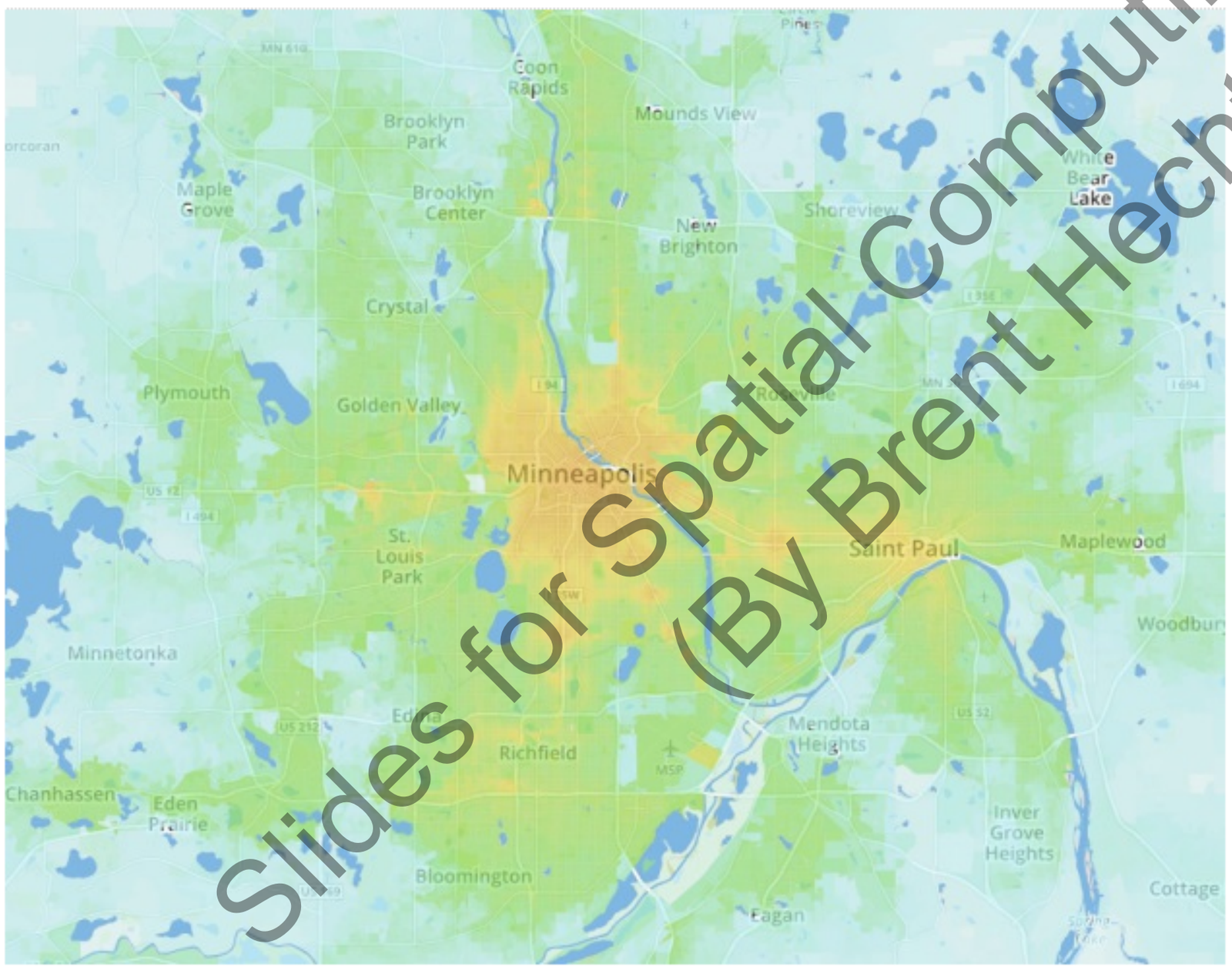
Heat Maps

MAP: The best places to [illegible] commuter

Posted by: Eric Roper | Updated: October 7, 2014 - 5

7 comments | print

Share 62 Tweet 20

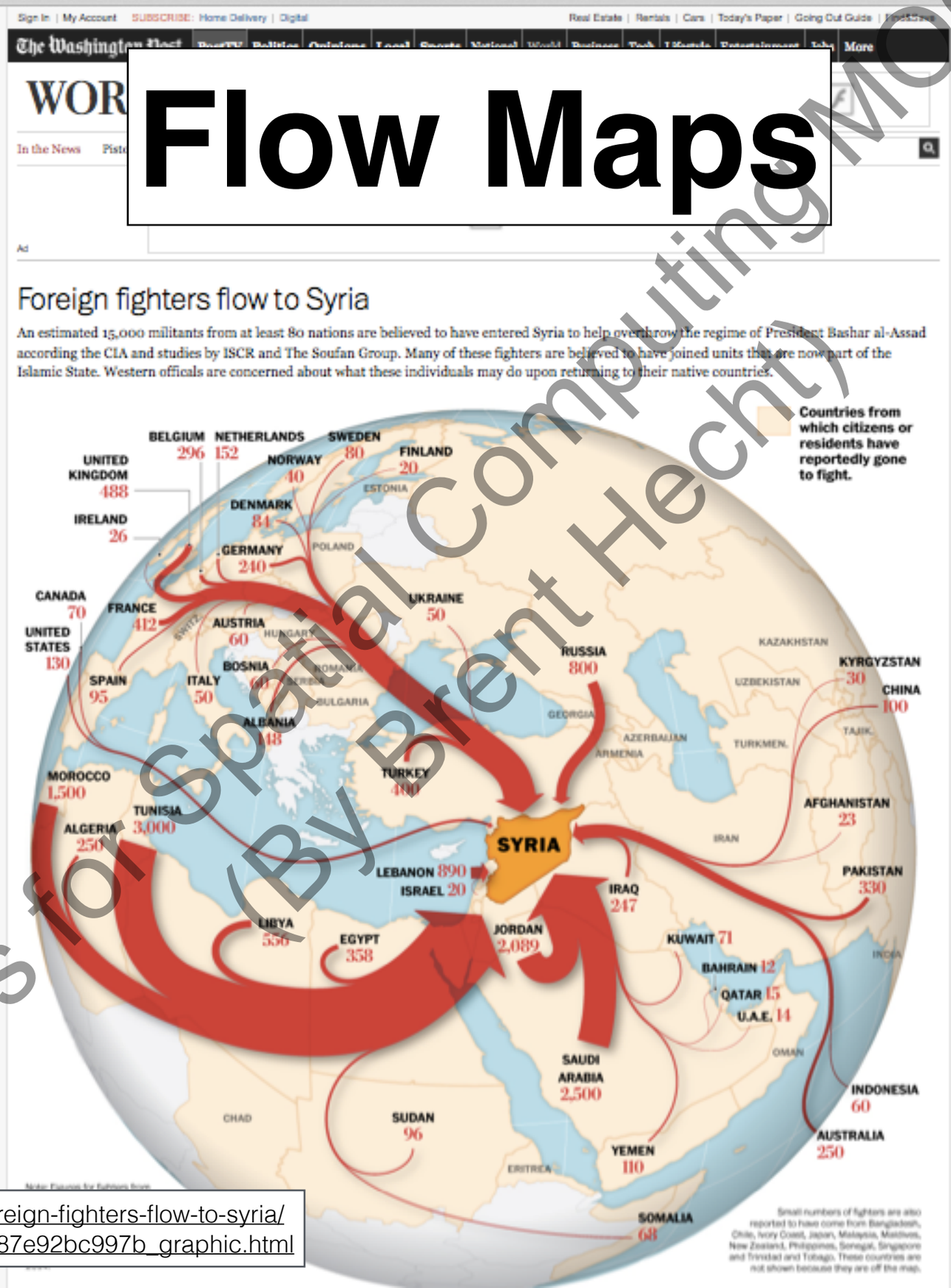


Above: Number of jobs accessible from different points within 30 minutes, between 7 a.m. and 9 a.m. Click here to see the full map, with a legend.

recent posts

- 2 Minneapolis officers praised for saving man stabbed downtown
- Man with dog shoots up 19 Bar, wounding two before fleeing
- Minneapolis seeks high-rise for Nicollet Hotel

Flow Maps



http://www.washingtonpost.com/world/foreign-fighters-flow-to-syria/2014/10/11/3d2549fa-5195-11e4-8c24-487e92bc997b_graphic.html

Cartography

Spatial Computing – University of Minnesota

Attributions

By Vladimir Menkov (Own work) [GFDL (http://www.gnu.org/copyleft/fdl.html), CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0/) or CC-BY-SA-2.5-2.0-1.0 (http://creativecommons.org/licenses/by-sa/2.5-2.0-1.0)], via Wikimedia Commons

Cartography

Spatial Computing – University of Minnesota

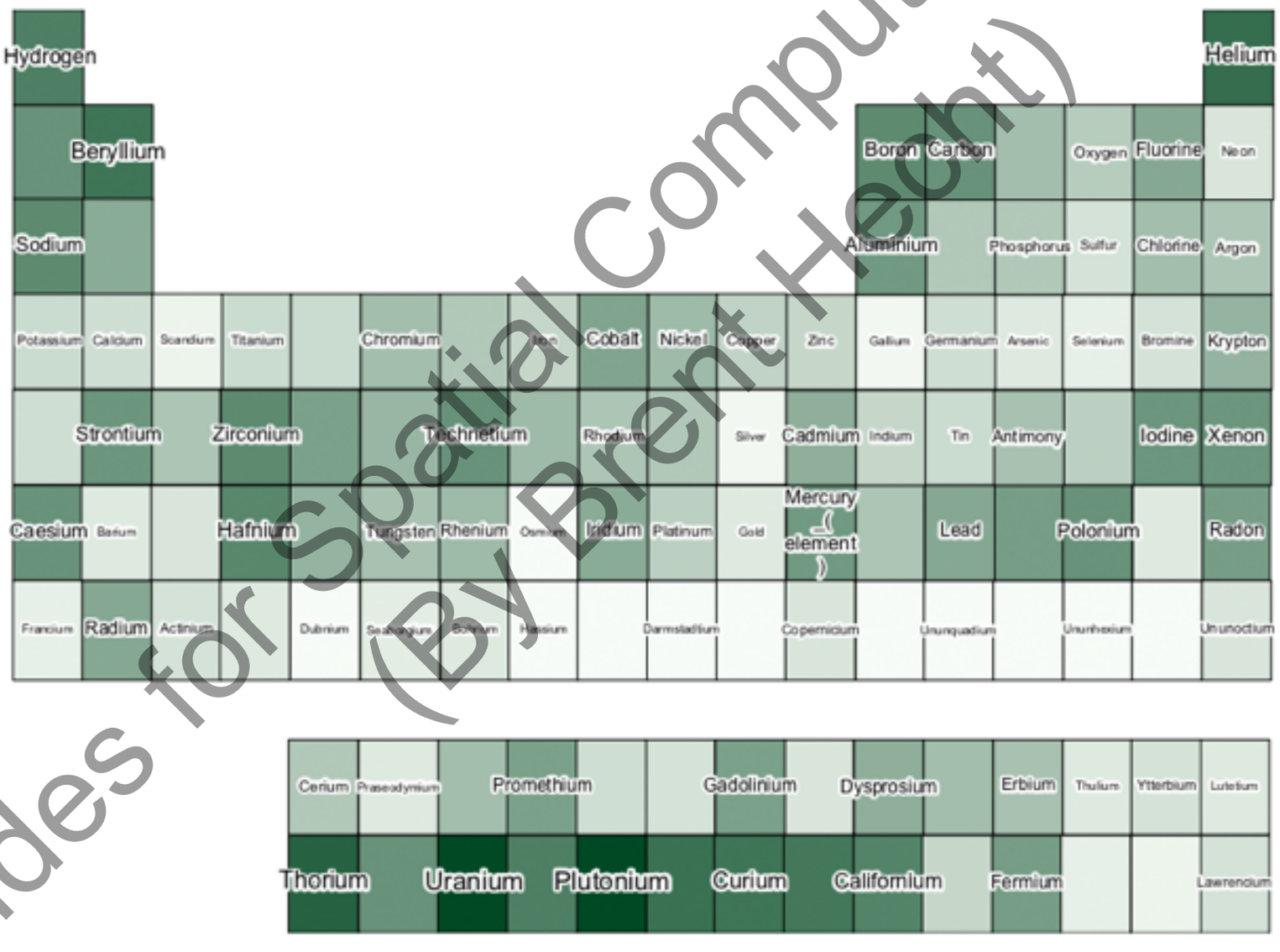
Cartography

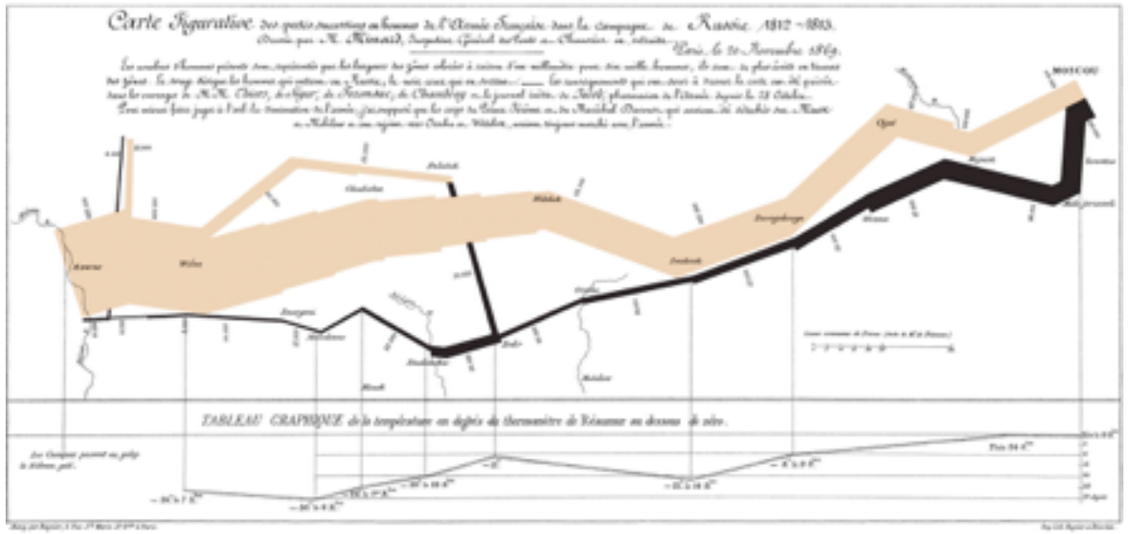
Spatial Computing – University of Minnesota

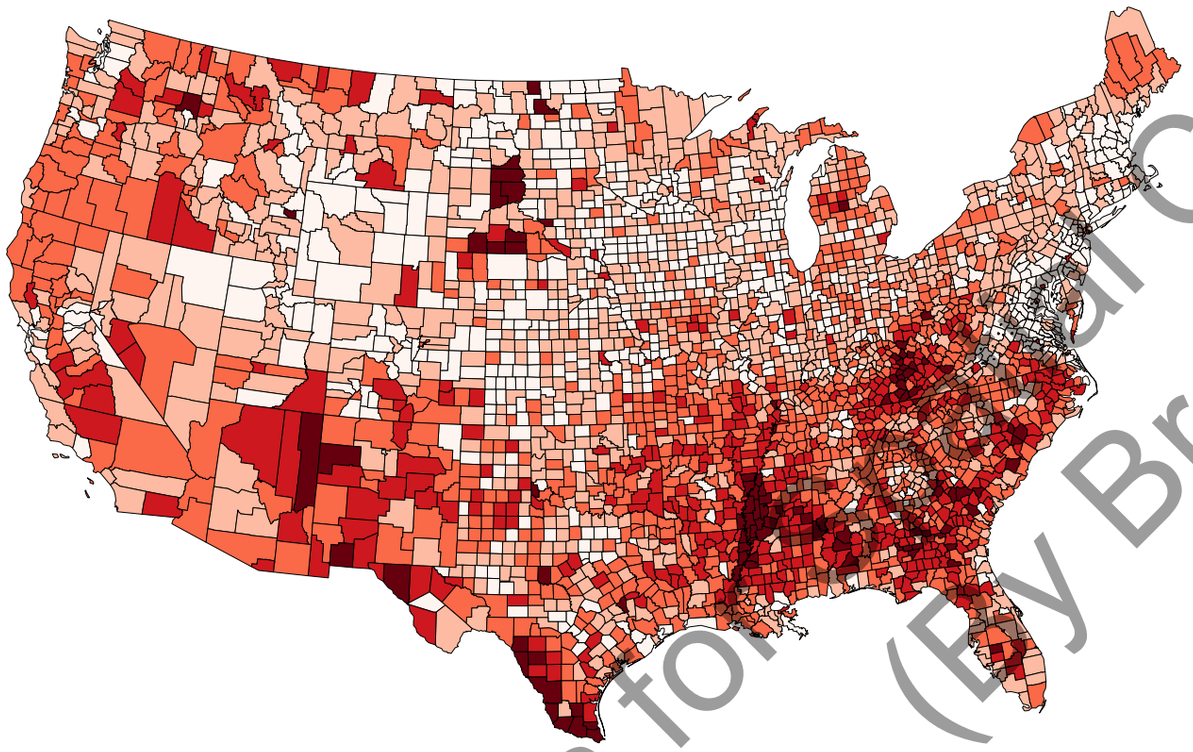
Learning Objectives

1. Understand the drastically **changed** (and changing) **professional context** of modern cartography.
2. Be able to distinguish between and understand the purpose of the two major types of maps: **reference and thematic**.
3. Know the **limitations** of popular online and mobile reference maps. (Technical track: Know how to get around them)
4. Be able to distinguish between types of **thematic maps** and choose the correct type for a given ***geocommunication*** need.
5. Have an understanding of some of the **computing-oriented innovation** going on in cartography (i.e. ***spatialization***)

Spatialization







Income Ladder, ...

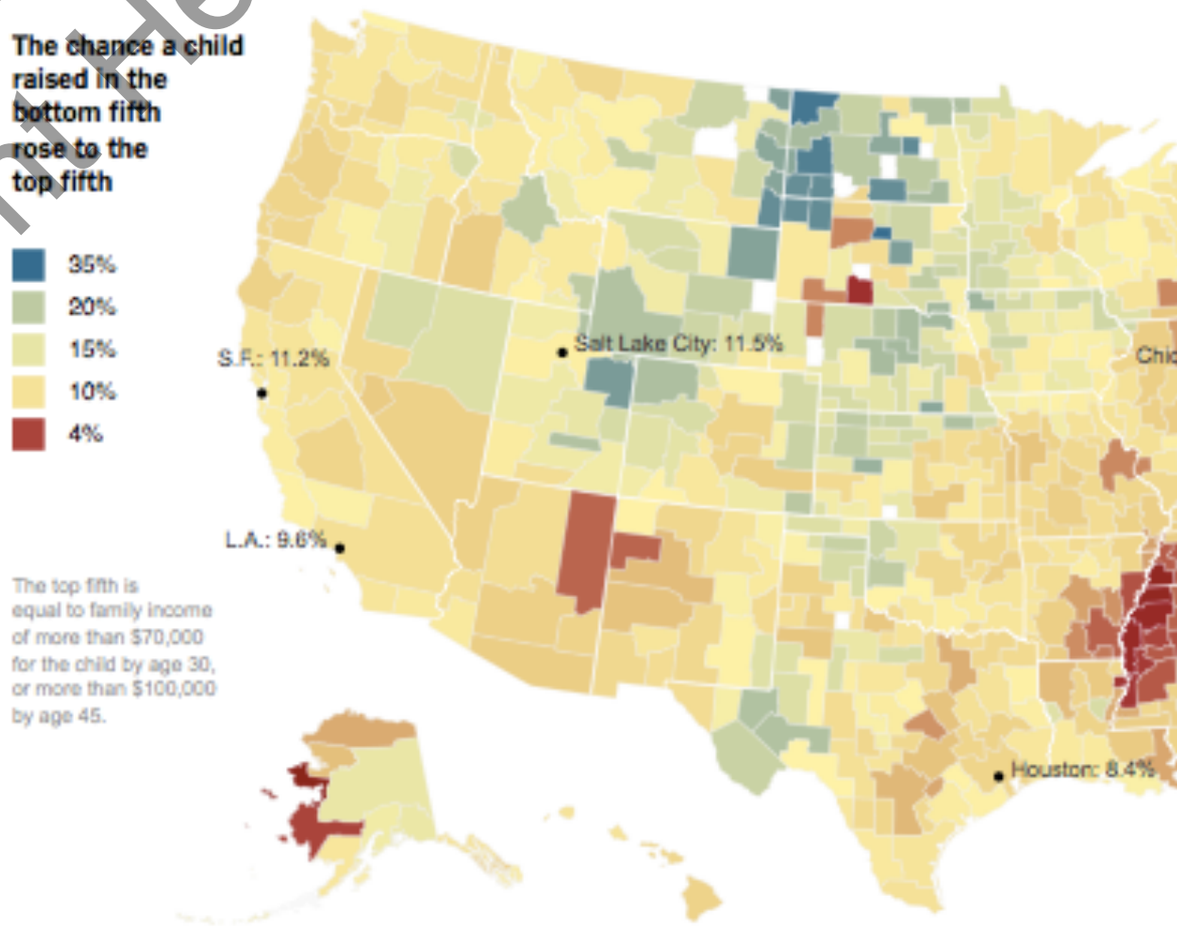
om/2013/07/22/business/in-climbing-income-ladder-location-matte

The New York Times

U.S.

In Climbing Income Ladder, Location M

A study finds the odds of rising to another income level are notably low in certain cities, like Atlanta and Charlotte, and much higher in New York and Boston.



E-MAIL

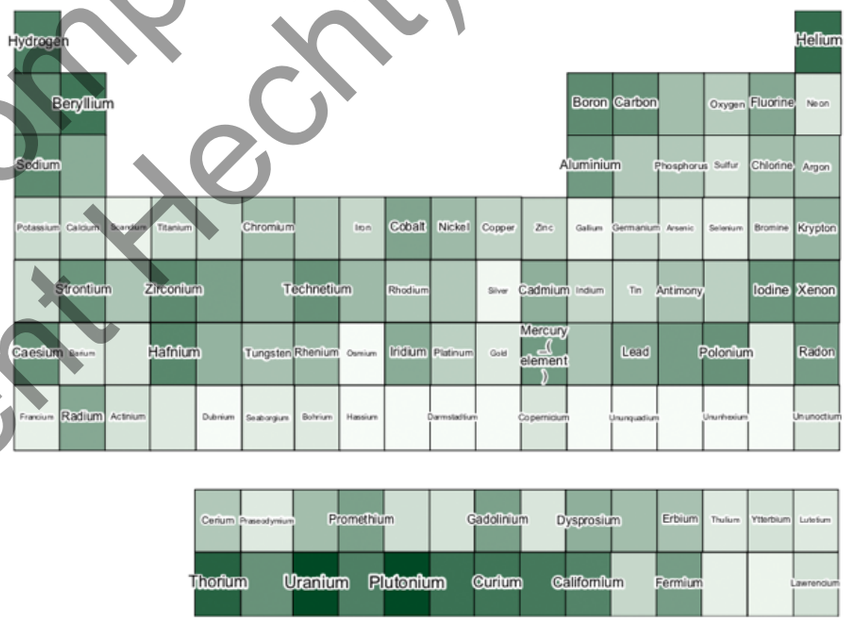
By DAVID LEONHARDT PUBLISHED: JULY 22, 2013 536 COMMENTS

ited in one
v important
ay…

There are **two types** of **spatialization**…

Implicit Spatialization

(e.g. Skupin and Fabrikant 2003)



Explicit Spatialization

(Hecht et al. 2012)

High-dimensional feature space

Multi-dimensional Scaling (MDS)

Kohonen Self-organizing Maps

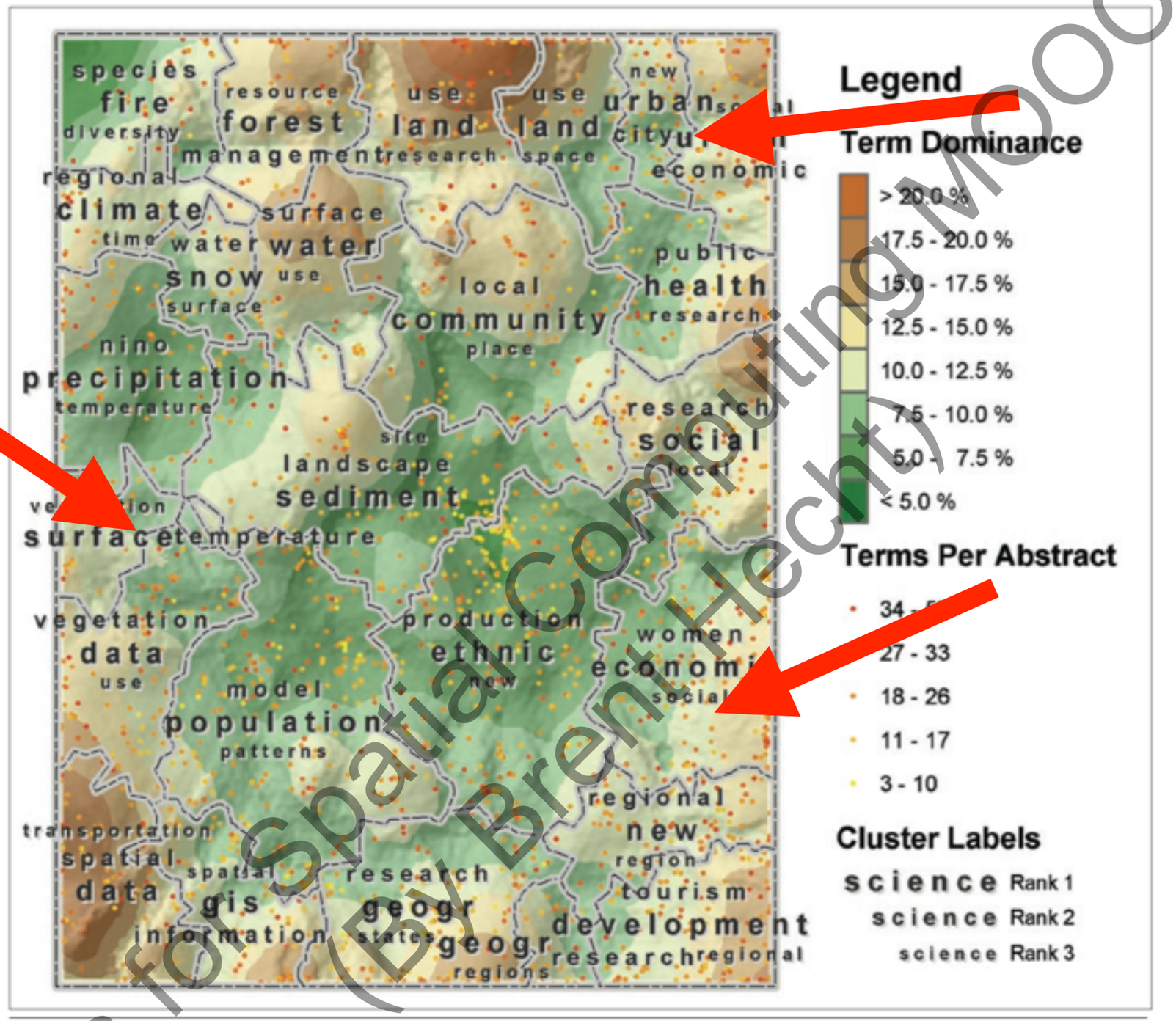


Figure 16. Visual support for evaluating cluster validity. The visualization is based on a 60-by-80 neuron SOM. It shows individual point locations for several thousand AAG conference abstracts, the 25-cluster level of a hierarchical cluster solution, ranked cluster labels, and an indication of how much the highest-ranked terms dominate particular regions. Low term dominance may indicate a lack of sharply defined themes and therefore the existence of relatively heterogeneous clusters.

(Skupin and Fabrikant 2003)

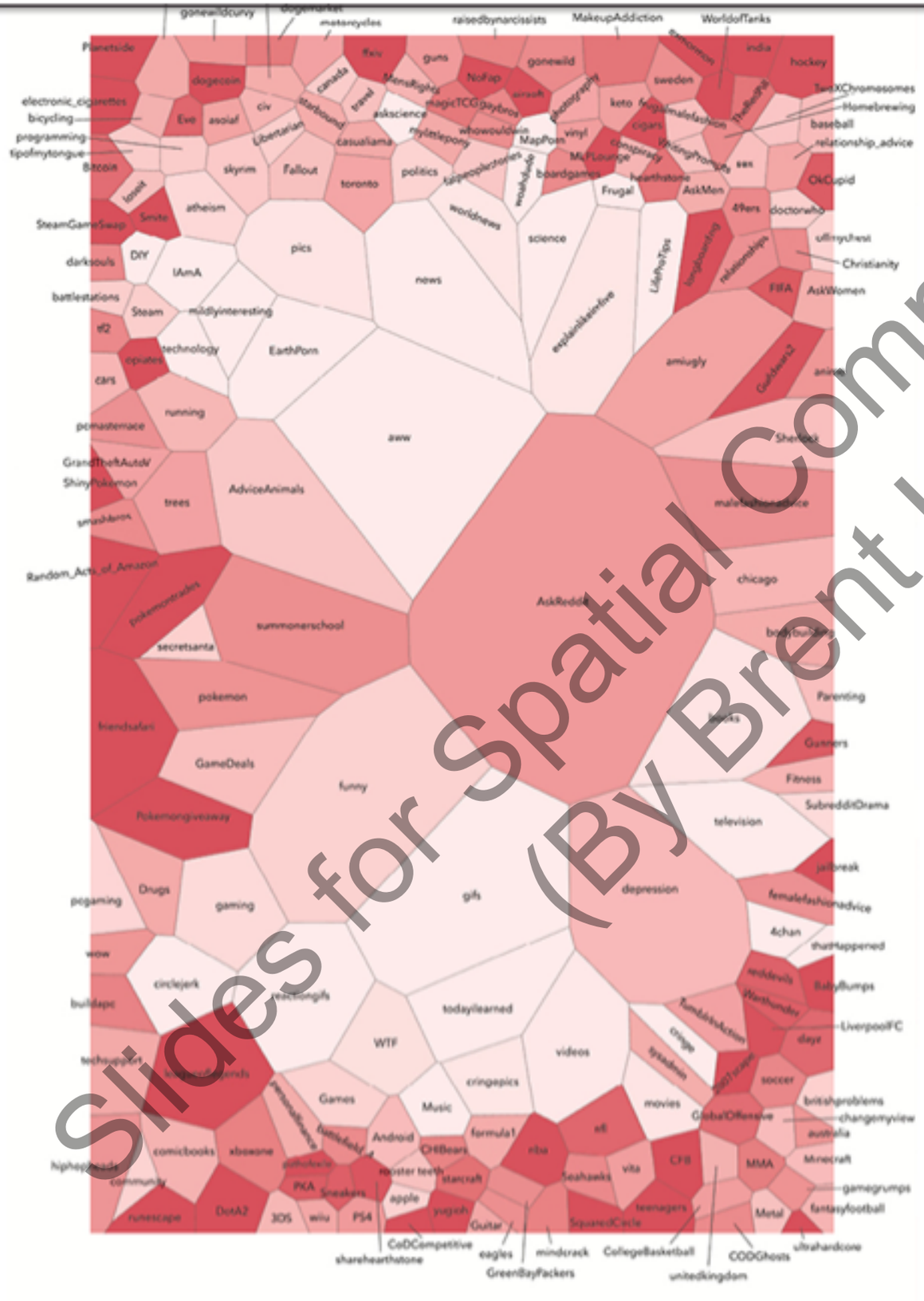
Mapmaking using Reddit, O…

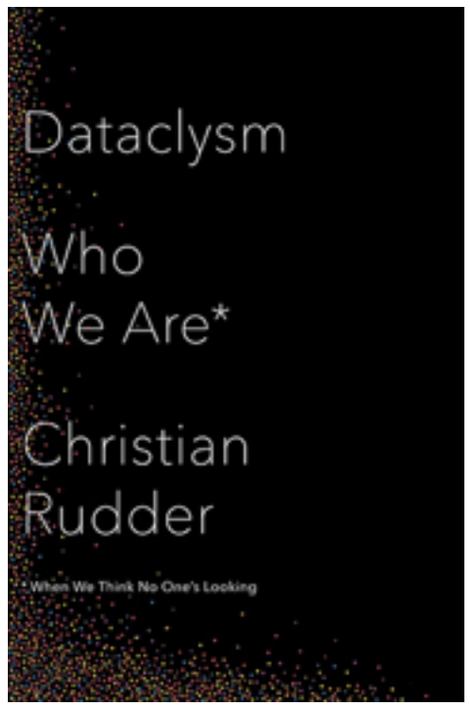
www.slate.com/articles/technology/technology/2014/10/mapmaking_using_reddit_ok

Google

WHAT WOULD THE UNITED STATES OF REDDIT LOOK LIKE MAPPED?

Slate



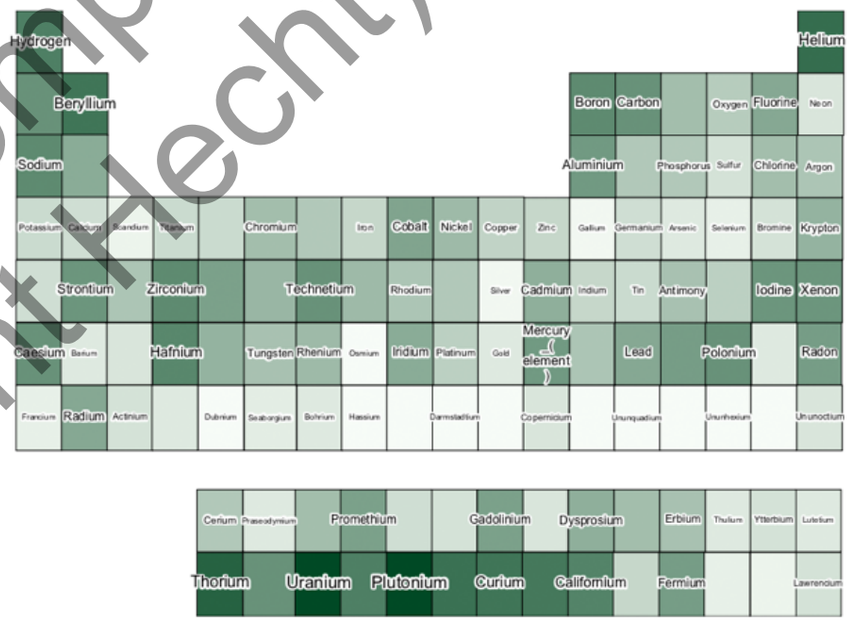


Map courtesy *Dataclysm: Who We Are When No One's Looking* by Christian Rudder

There are **two types** of **spatialization**…

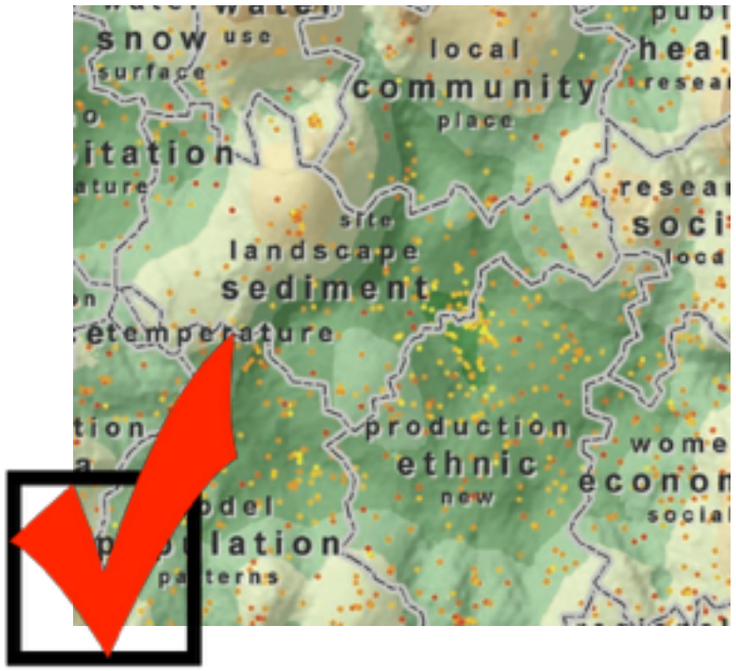
Implicit Spatialization

(e.g. Skupin and Fabrikant 2003)



Explicit Spatialization

(e.g. Hecht et al. 2012)



Implicit Spatialization

(e.g. Skupin and Fabrikant 2003)

Explicit Spatialization

(e.g. Hecht et al. 2012)

Data-driven, implicit reference systems

Real-life reference systems

Dr. Kirk Goldsberry

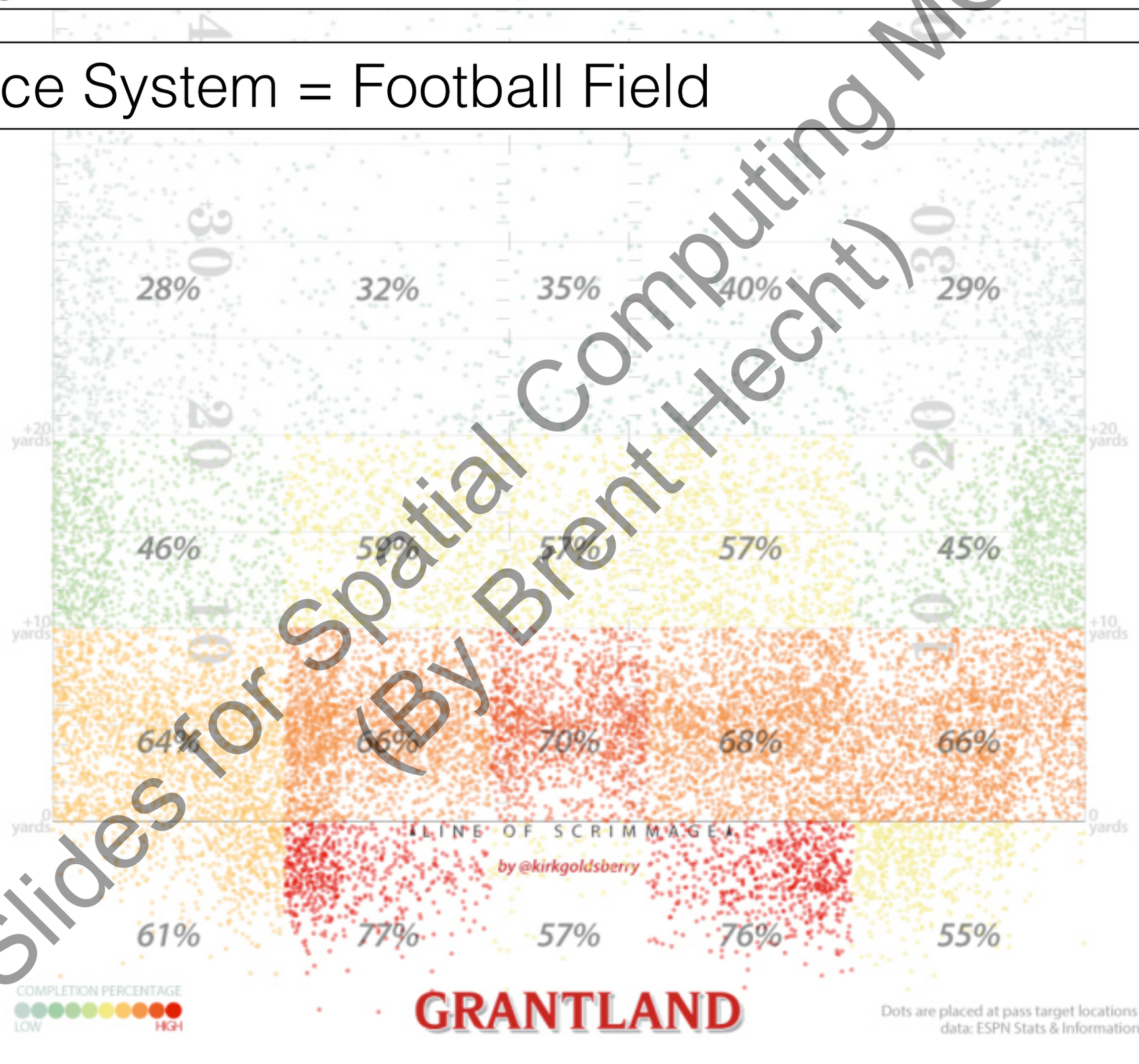
Geography Professor
@ Michigan State

Visiting Professor
@ Harvard

Contributor

http://grantland.com/the-triangle/pass-atlas-peyton-manning-vs-the-seahawks-pass-defense/

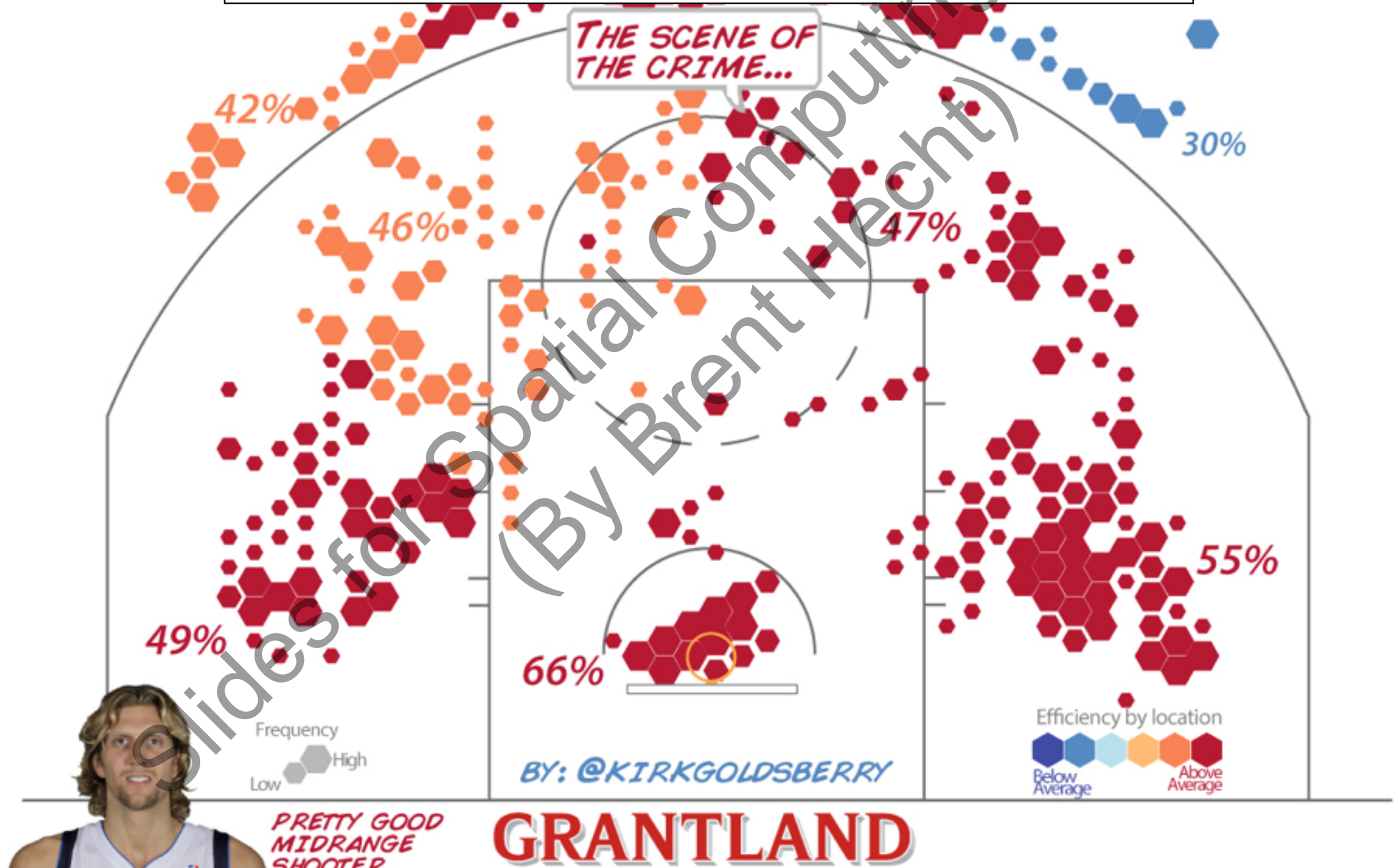
Reference System = Football Field



Dirk Nowitzki Buzzer Beater in New York!

http://grantland.com/the-triangle/nba-overnight-dirk-is-out-here-playing-h-o-r-s-e-with-peoples-lives/

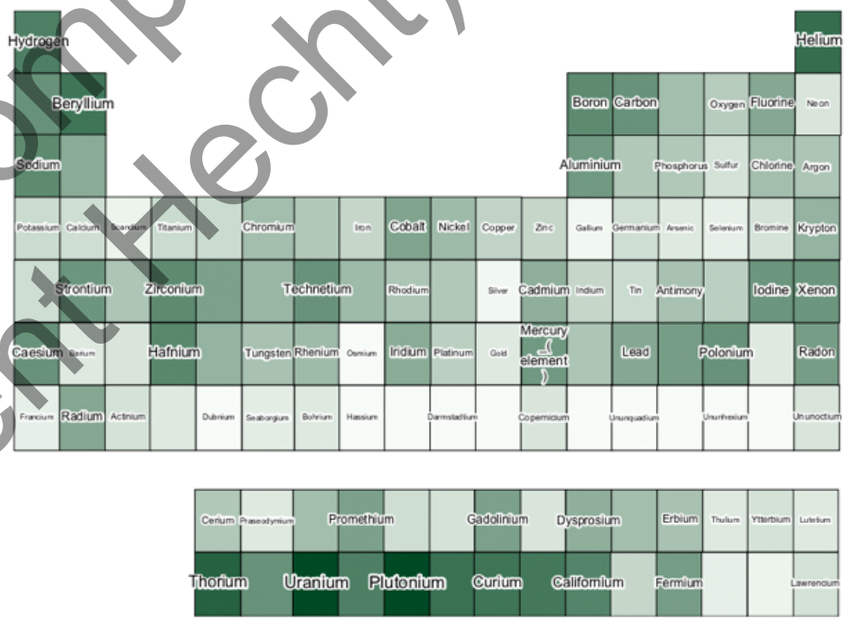
Reference System = Basketball Court



There are **two types** of **spatialization**…

Implicit Spatialization

(e.g. Skupin and Fabrikant 2003)



Explicit Spatialization

(Hecht et al. 2012)

Cartography

Spatial Computing – University of Minnesota

Attributions

"Globe" symbol by Bart Laugs of The Noun Project