Cartography

Spatial Computing – University of Minnesota

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Learning Objectives

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3. Know the **limitations** of popular online and mobile reference maps. (Technical track: Know how to get around them)
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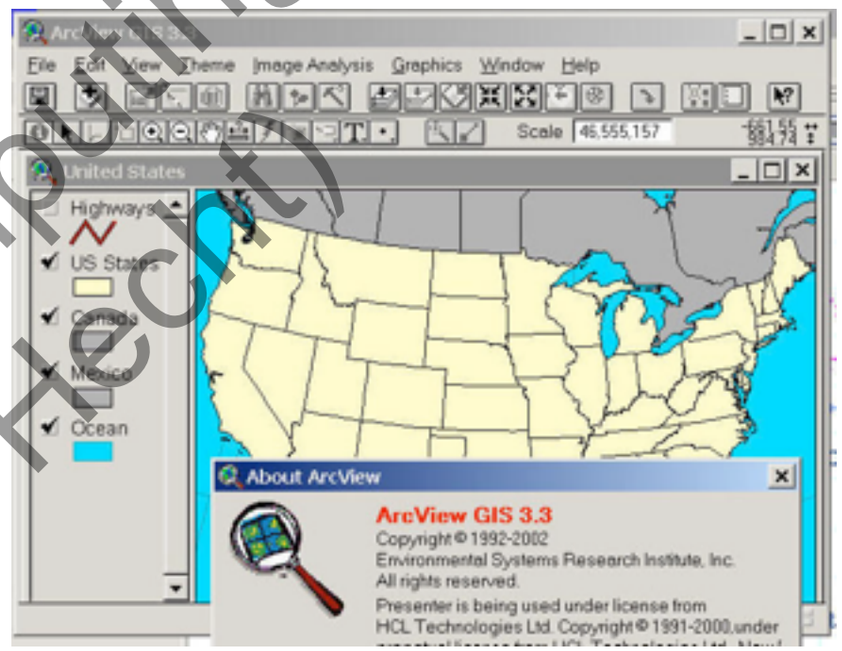
5. Have an understanding of some of the **computing-oriented innovation** going on in cartography (i.e. ***spatialization***)

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
Google
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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

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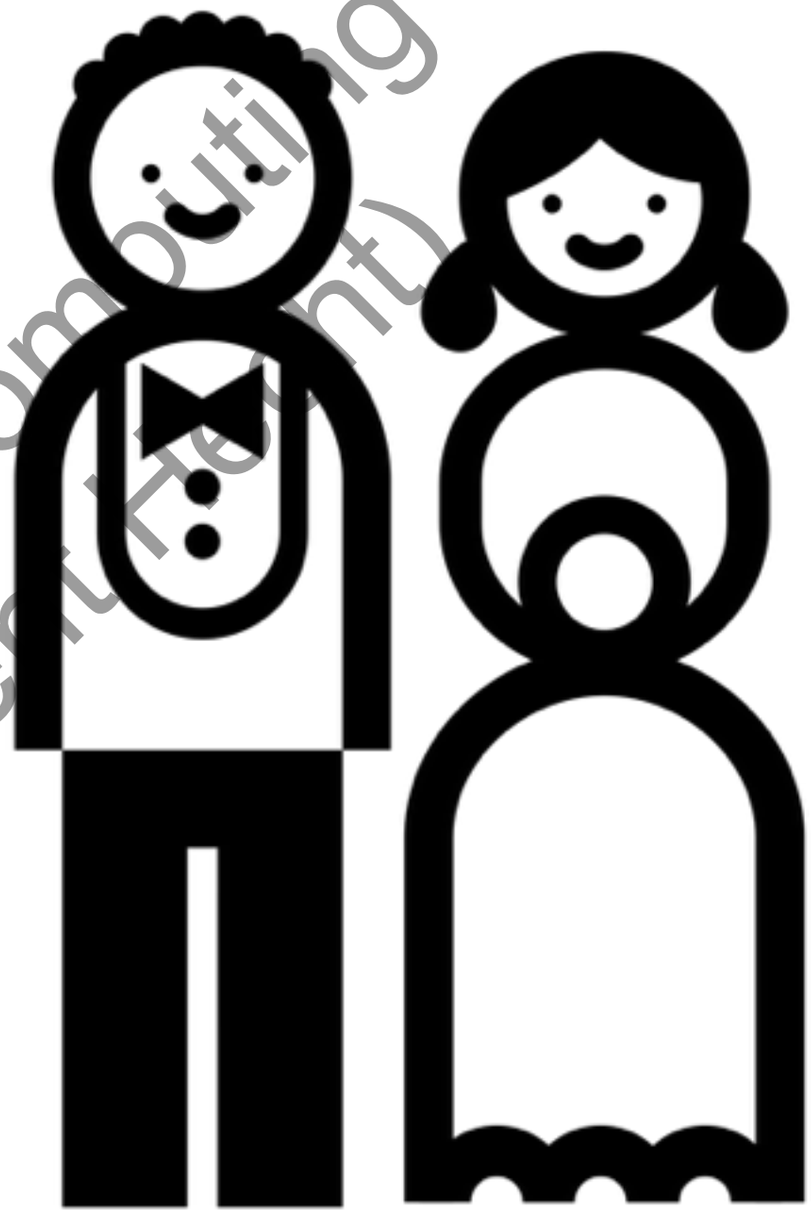
WEDDING EVENTS:

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

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

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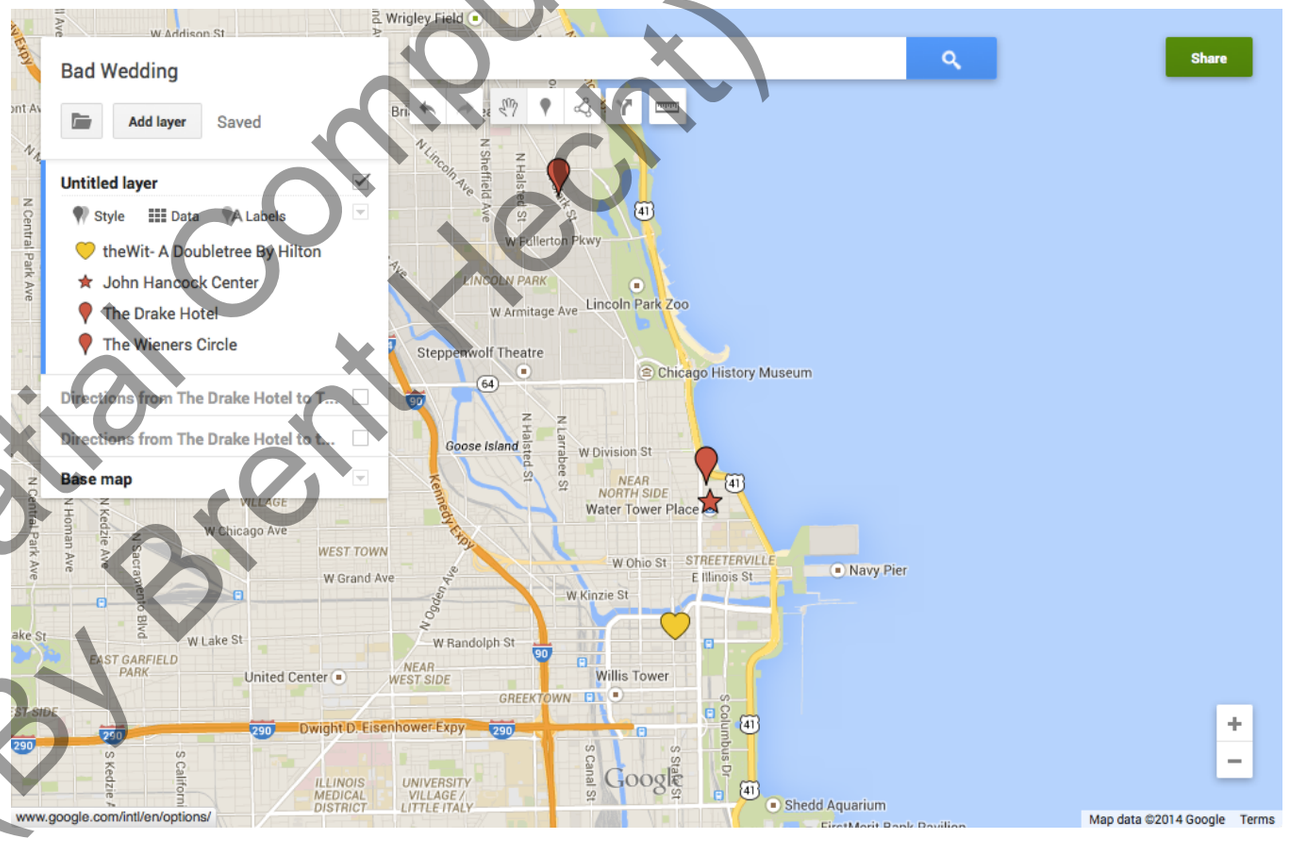

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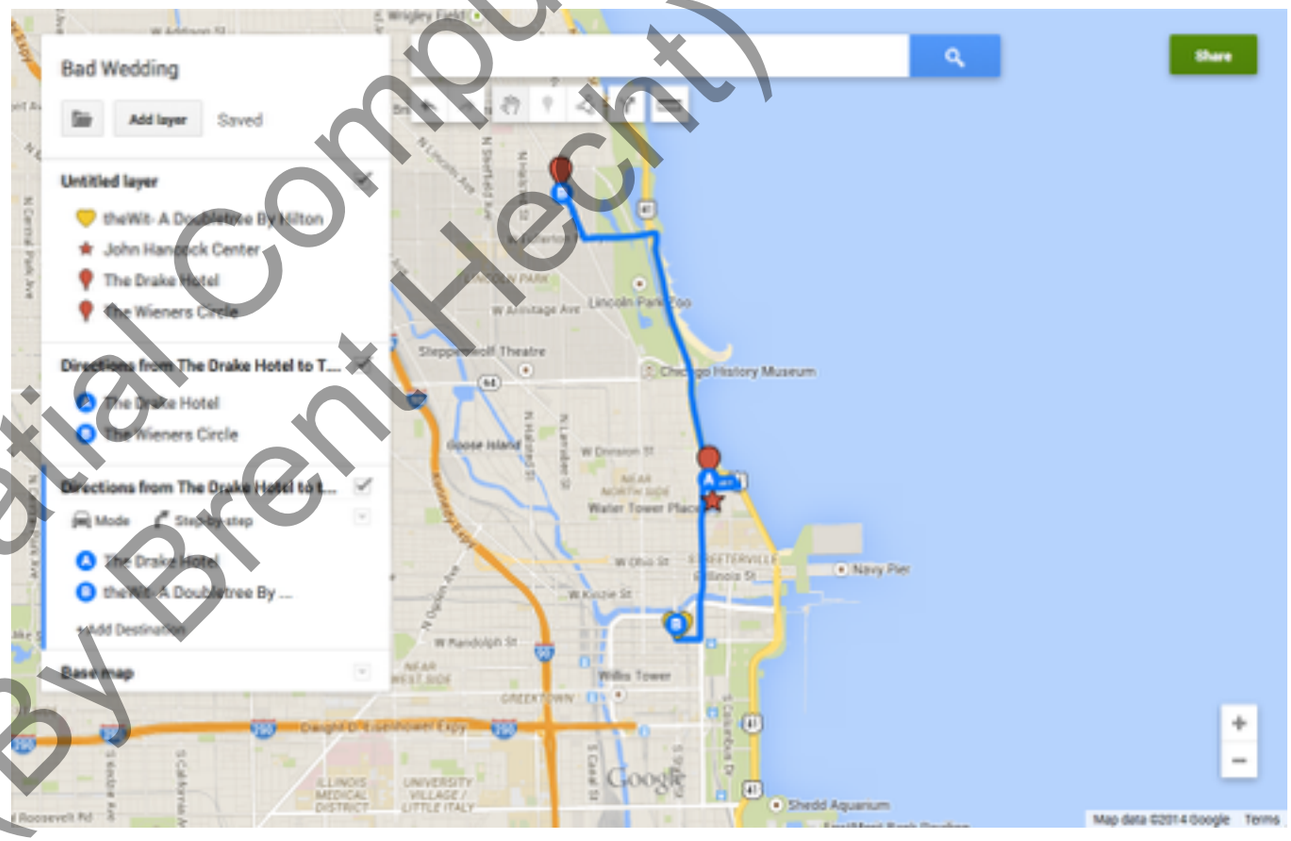

Google Maps

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

Google

Traffic, Transit, Bicycling, Terrain, Directions

+Brent

Brunch!

Hotel and Reception

Ceremony!

Earth

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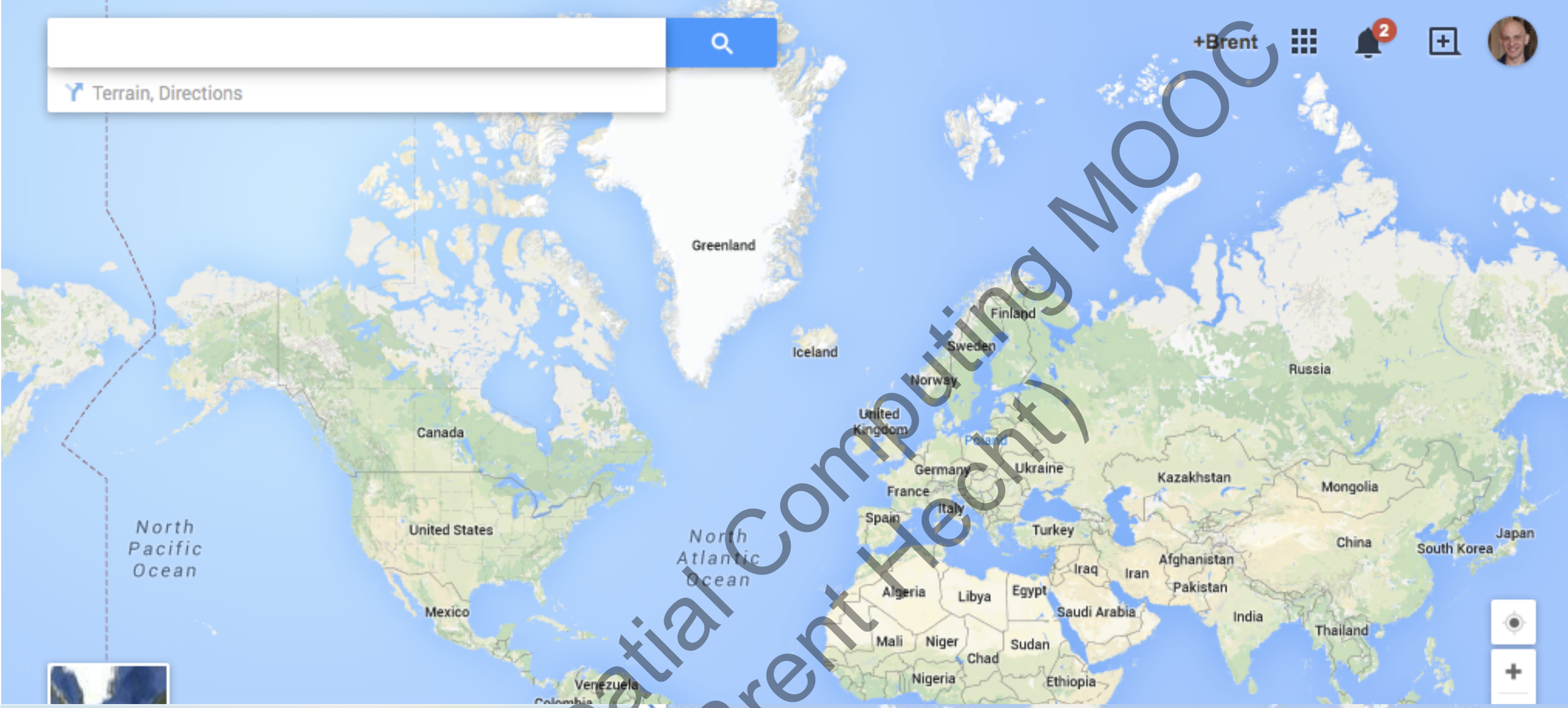
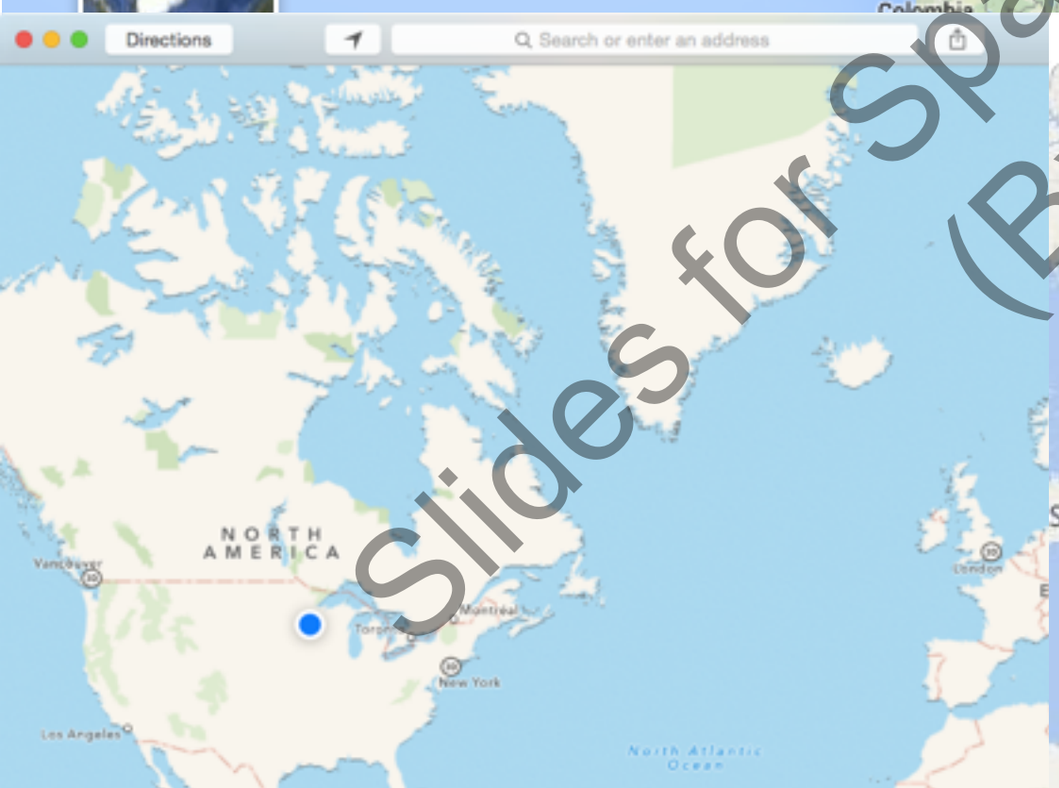
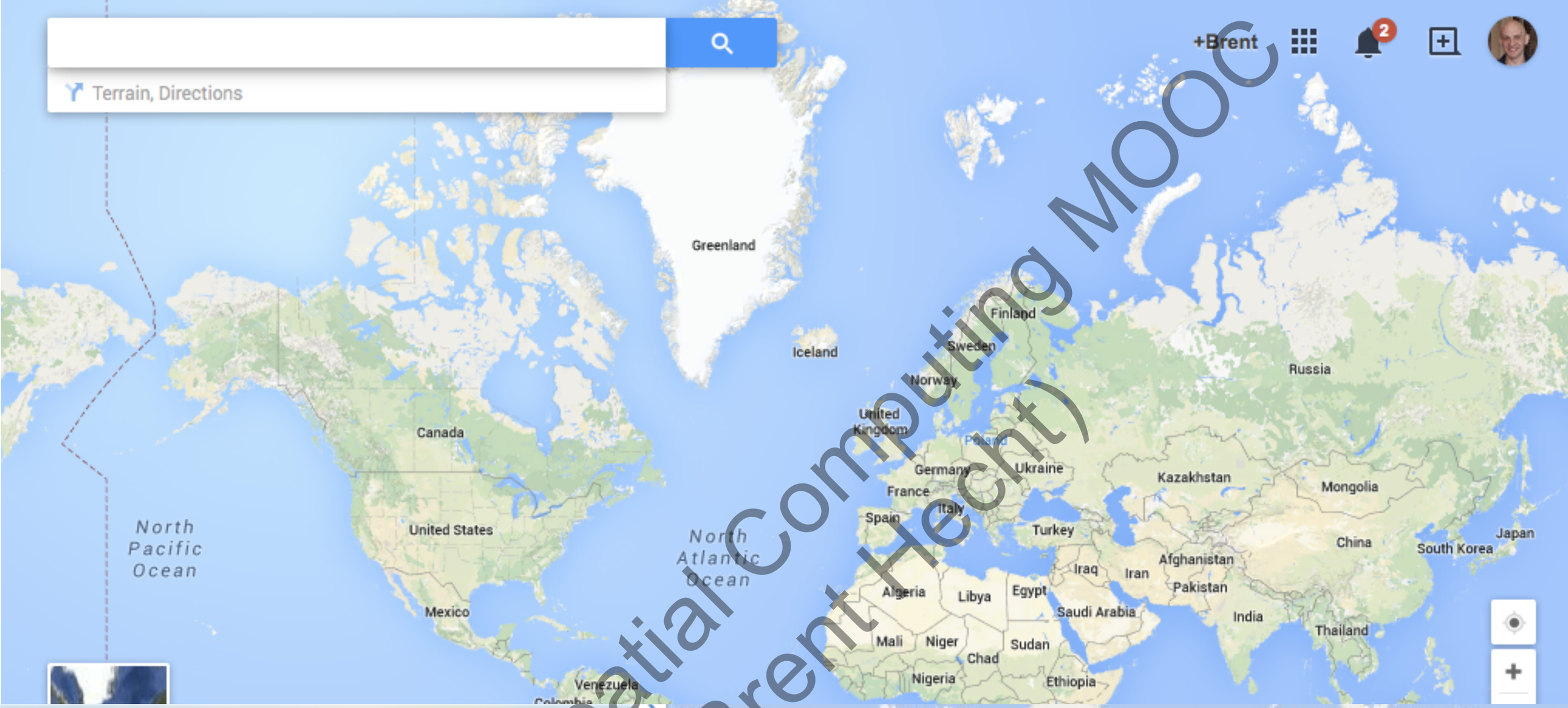
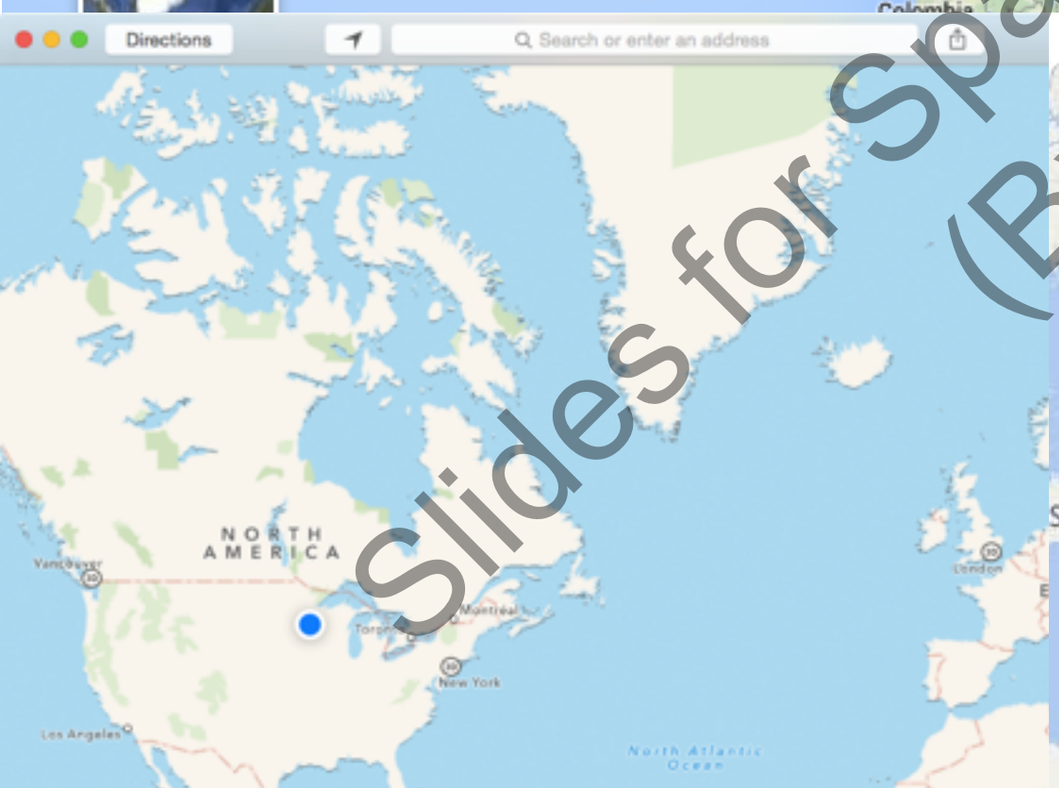
Limitations of popular online and mobile **reference maps**:

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.*

WIKIPEDIA
The Free Encyclopedia

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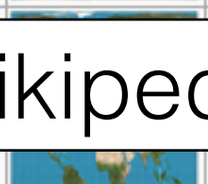
List of map projections

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)

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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

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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

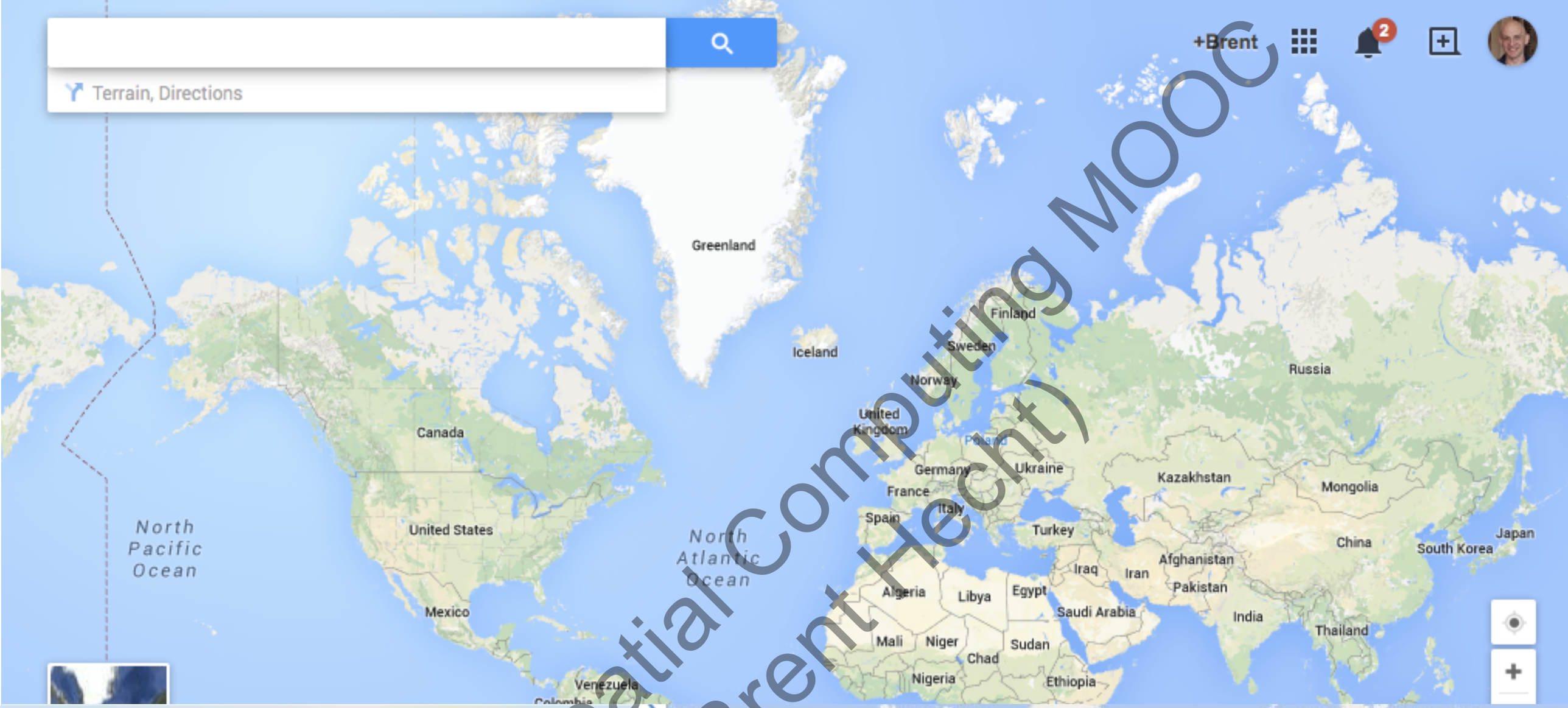
Earth

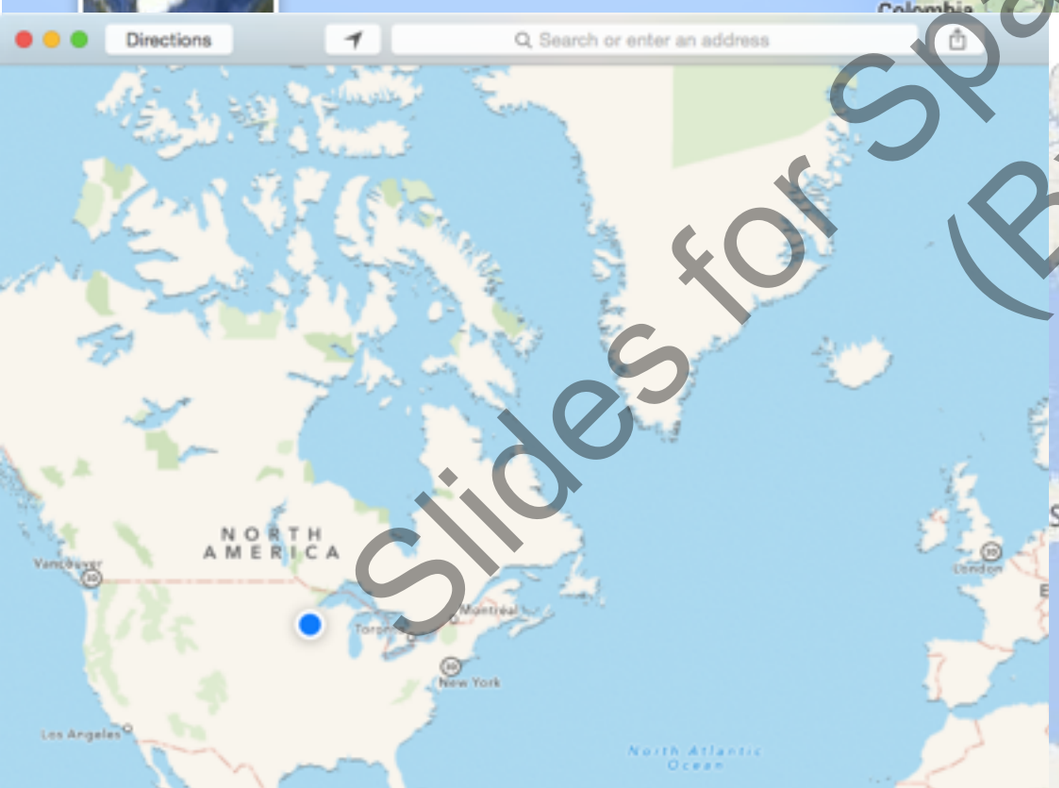
Google

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.

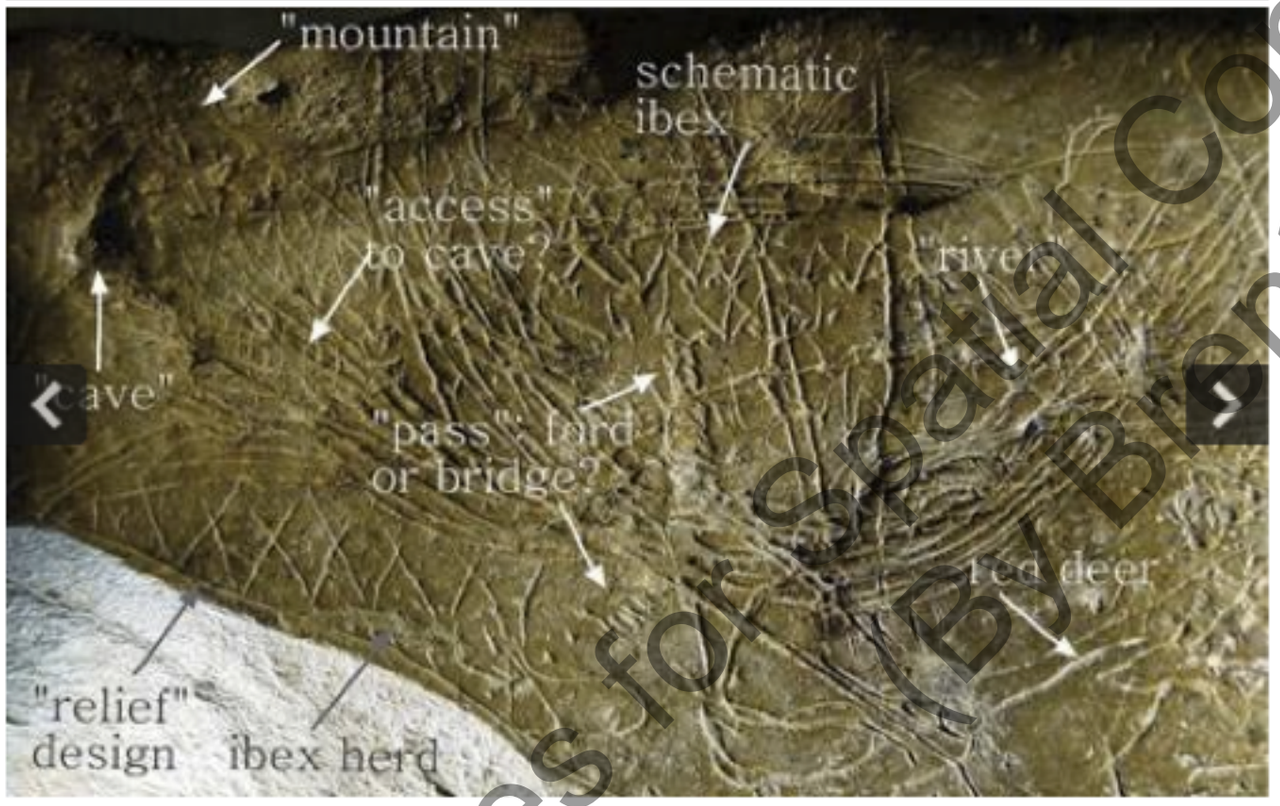

Image 1 of 2
Archaeologists have discovered what they believe is man's earliest map, dating from almost 14,000 years ago Photo: EPA

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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The best way to transfer money overseas

In Spain

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

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

Google

Using maps in print

I'd like to use your maps in print. What do I need to know?

Google Maps and Earth has built-in print functionality. You may print Content from Maps and Earth for personal use and enlarge it. In all uses where print will be distributed, first be sure to read our FAQ on applicable product Terms of Service and fair use. Second, all uses must properly show attribution to both Google and our data providers. Please see our attribution page for more information.

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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

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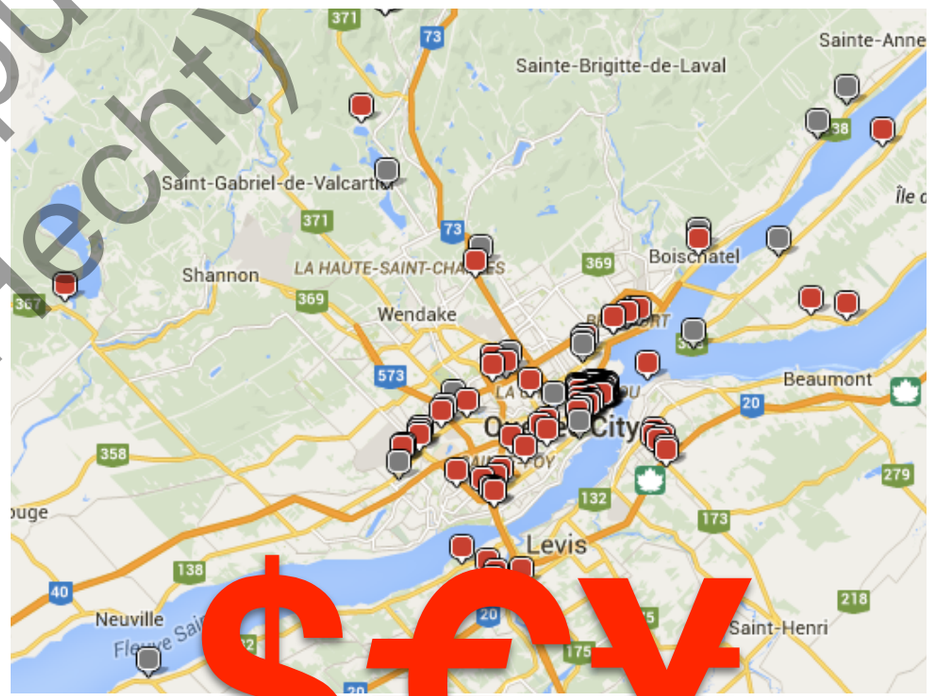

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www.openstreetmap.org/#map=13/51.9634/7.6245

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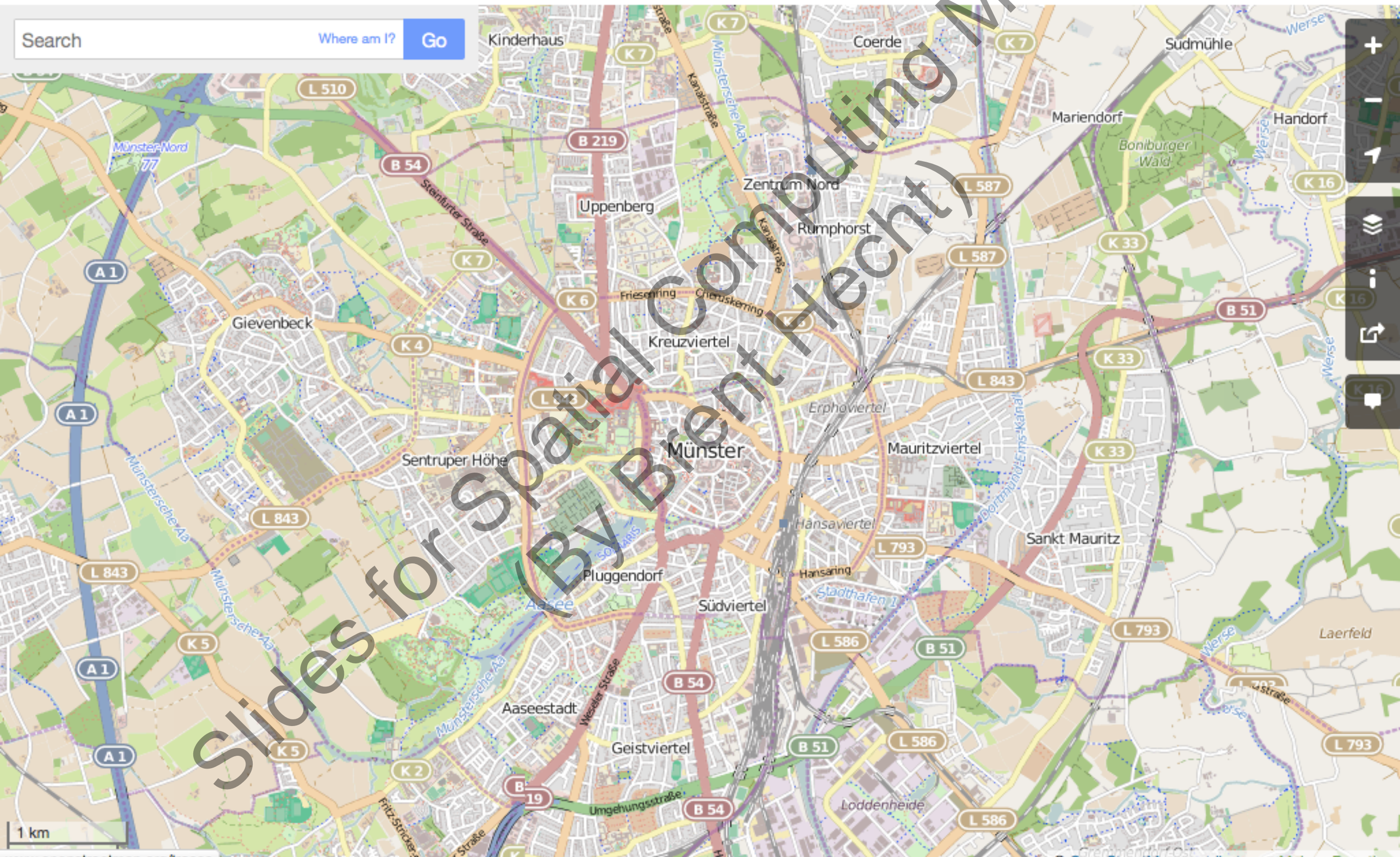

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2. Paper maps are still better in a few ways
3. Terms of use limitations

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

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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

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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
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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

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

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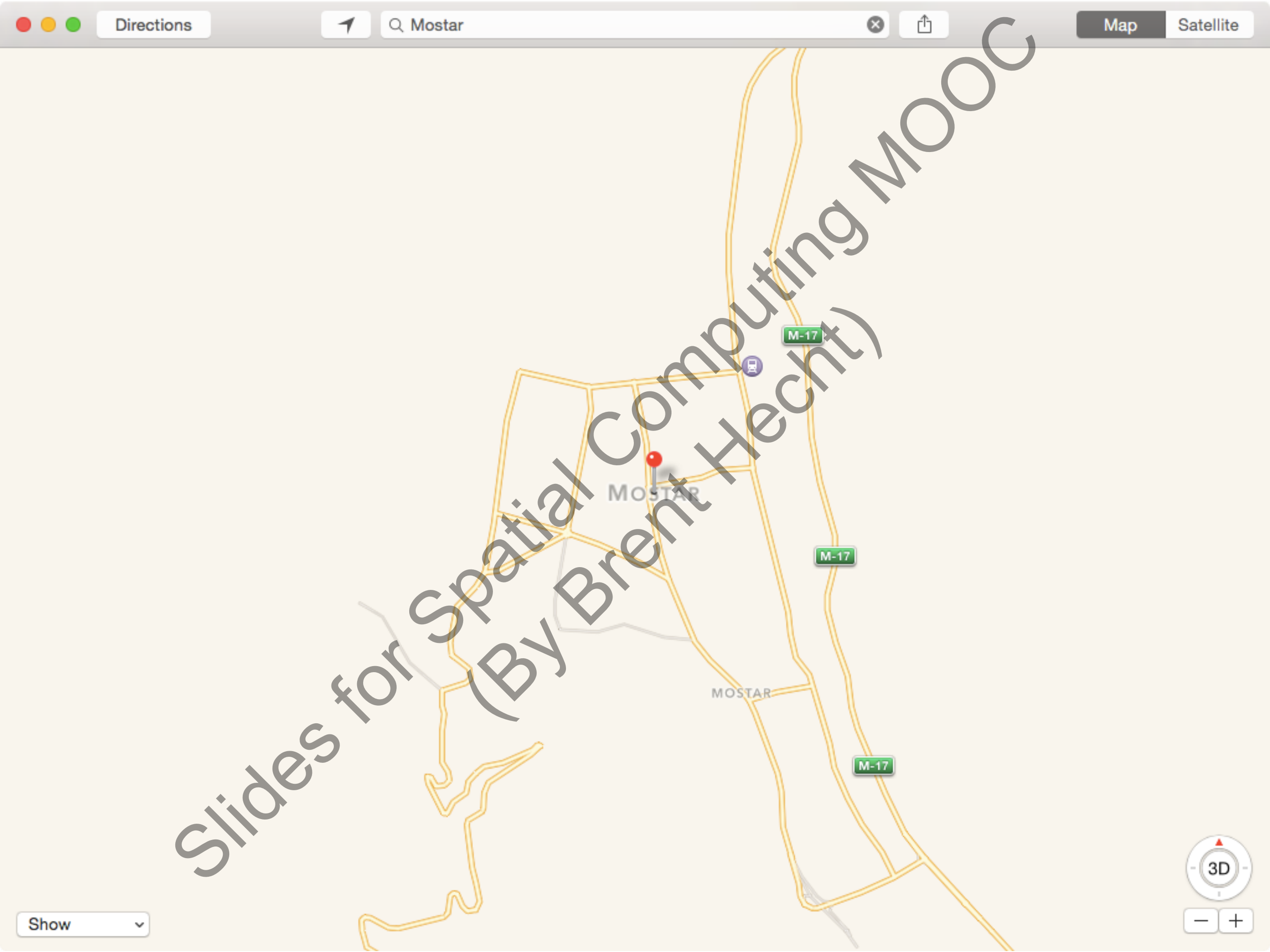
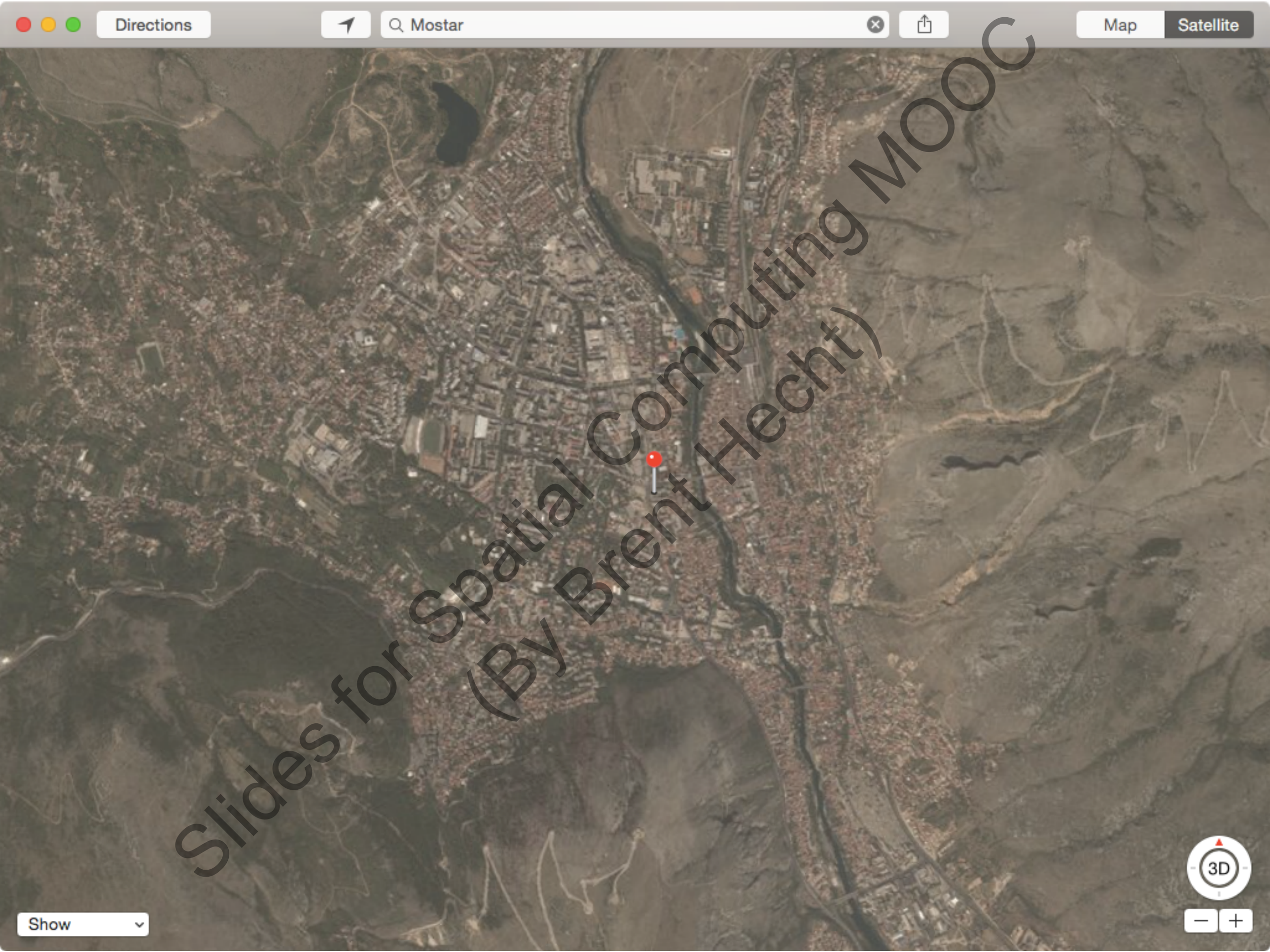
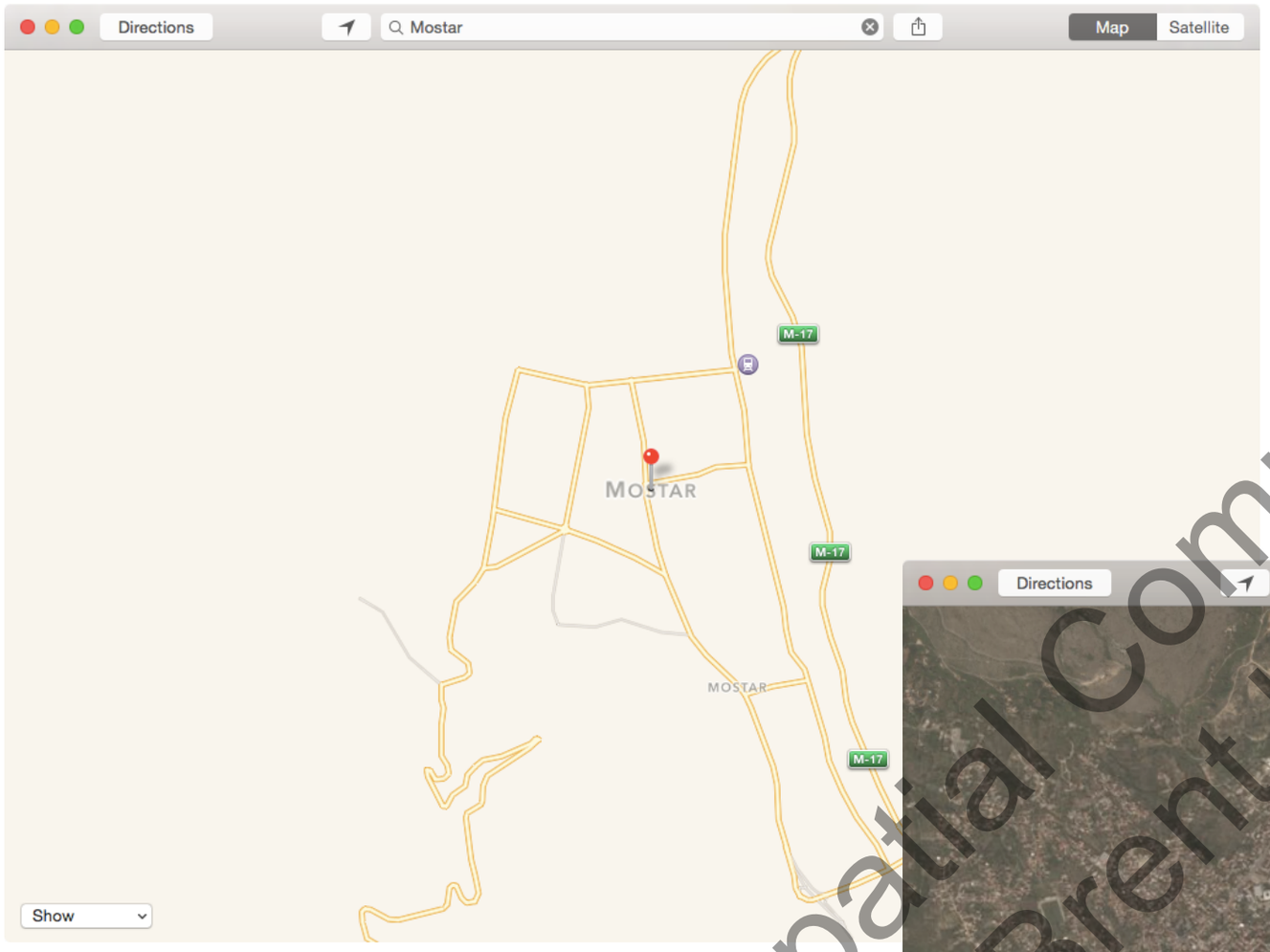
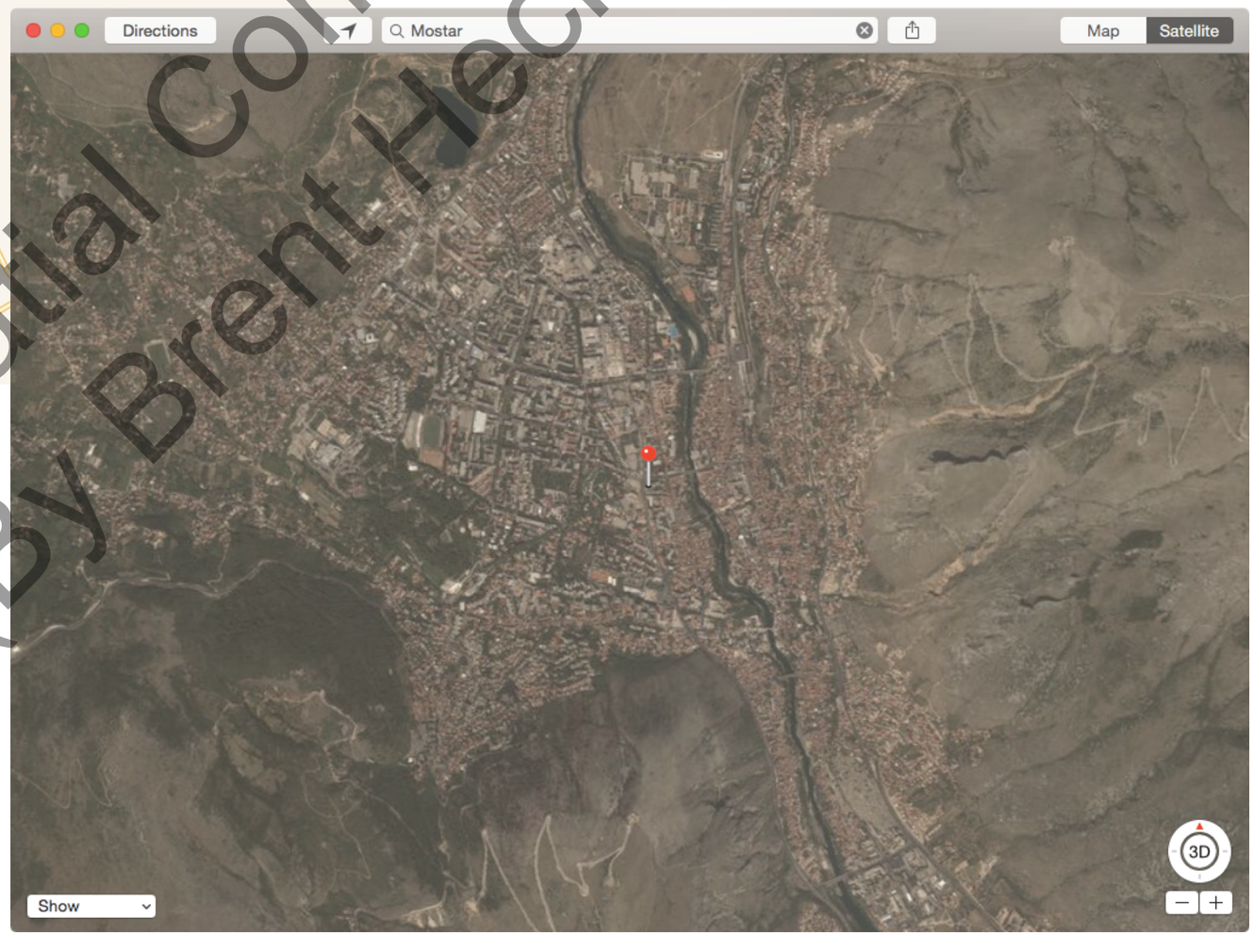
2. Paper maps are still better in a few ways
3. Terms of use limitations
4. Cartographic hegemony









Directions

Santa Barbara, CA

Map | Satellite

Santa Barbara, CA
Santa Barbara, CA, United States

Show

3D

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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

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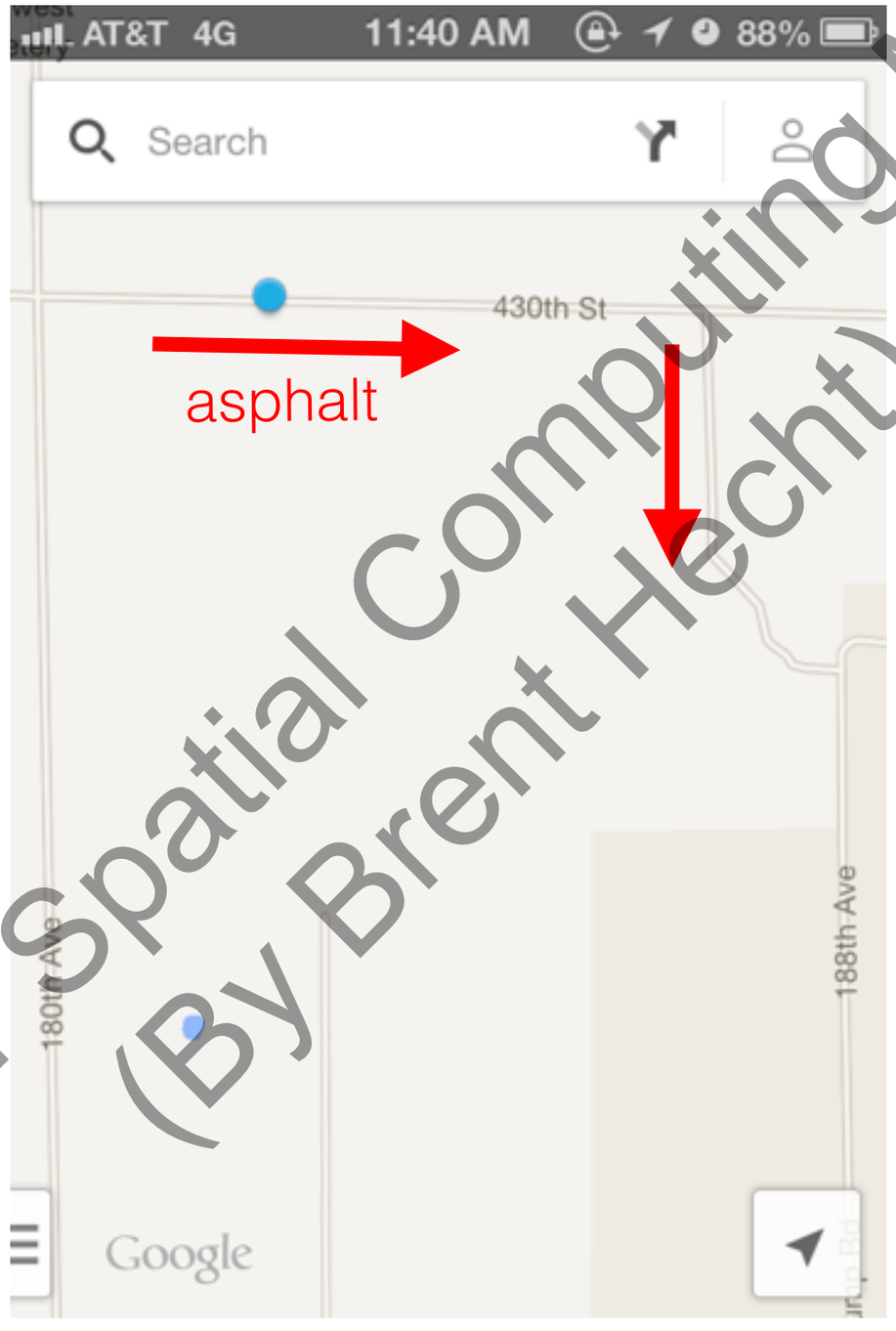

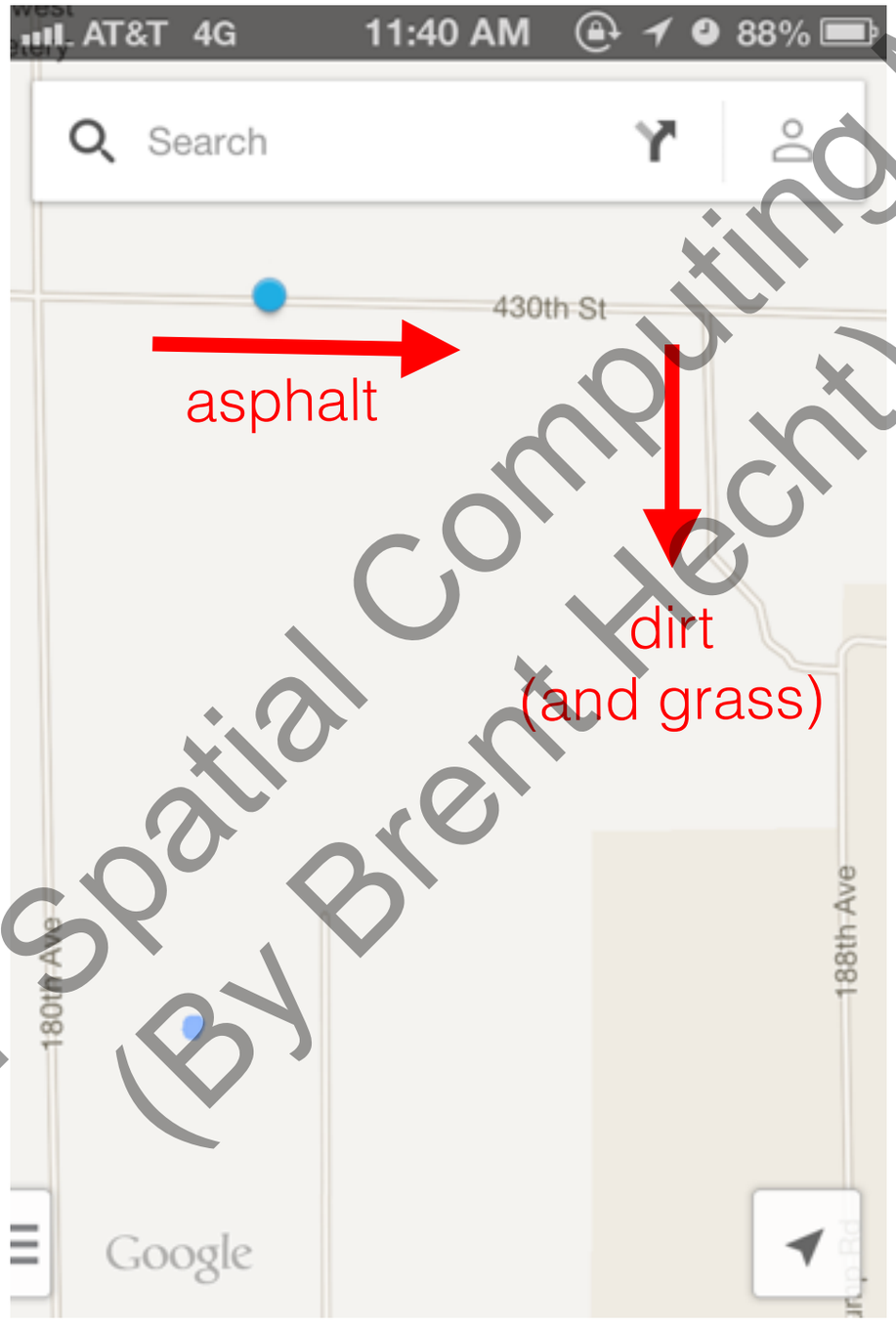

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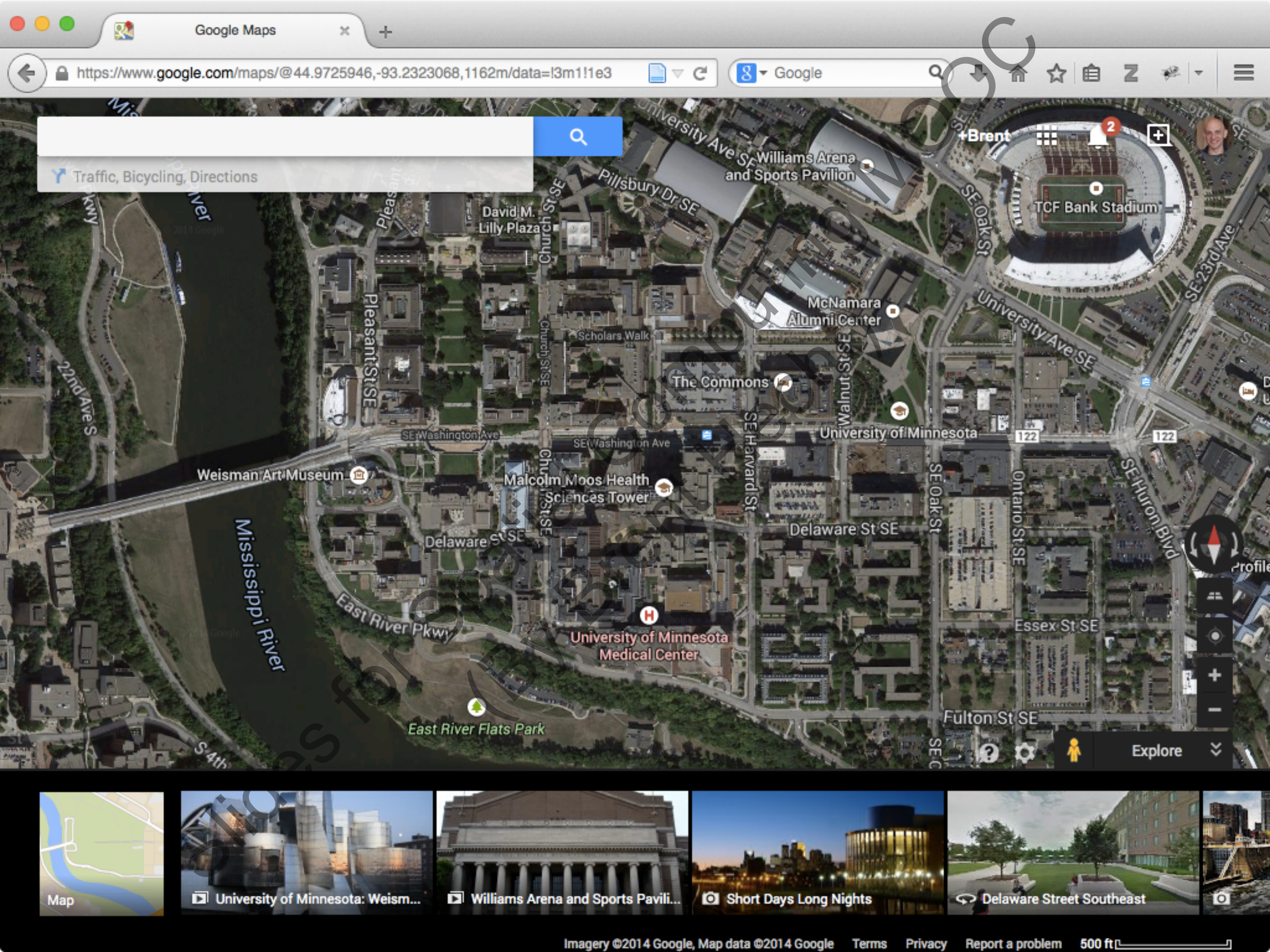
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2
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TCF Bank Stadium
University Ave SE
Pillsbury Dr SE
David M. Lilly Plaza
Church St SE
SE Oak St
McNamara Alumni Center
Scholars Walk
Pleasant St SE
The Commons
Walnut St SE
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SE Harvard St
122
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Weisman Art Museum
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Base map

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PROSPECT PARK

Yale Ave SE

Franklin Ave SE

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Google My Maps: “Terrain” Base Map

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