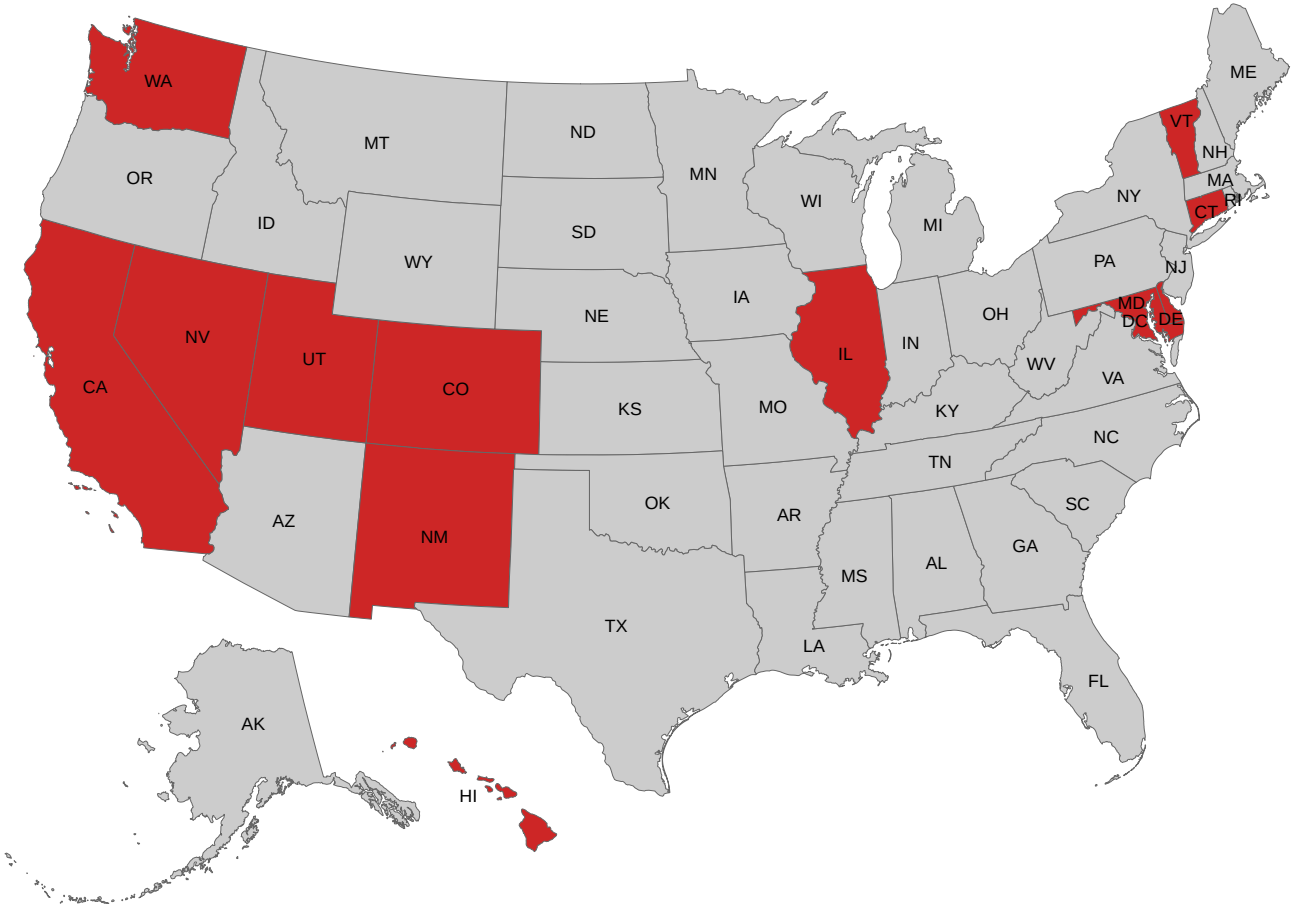
Geocoding and Mapping in R

Hans Lueders

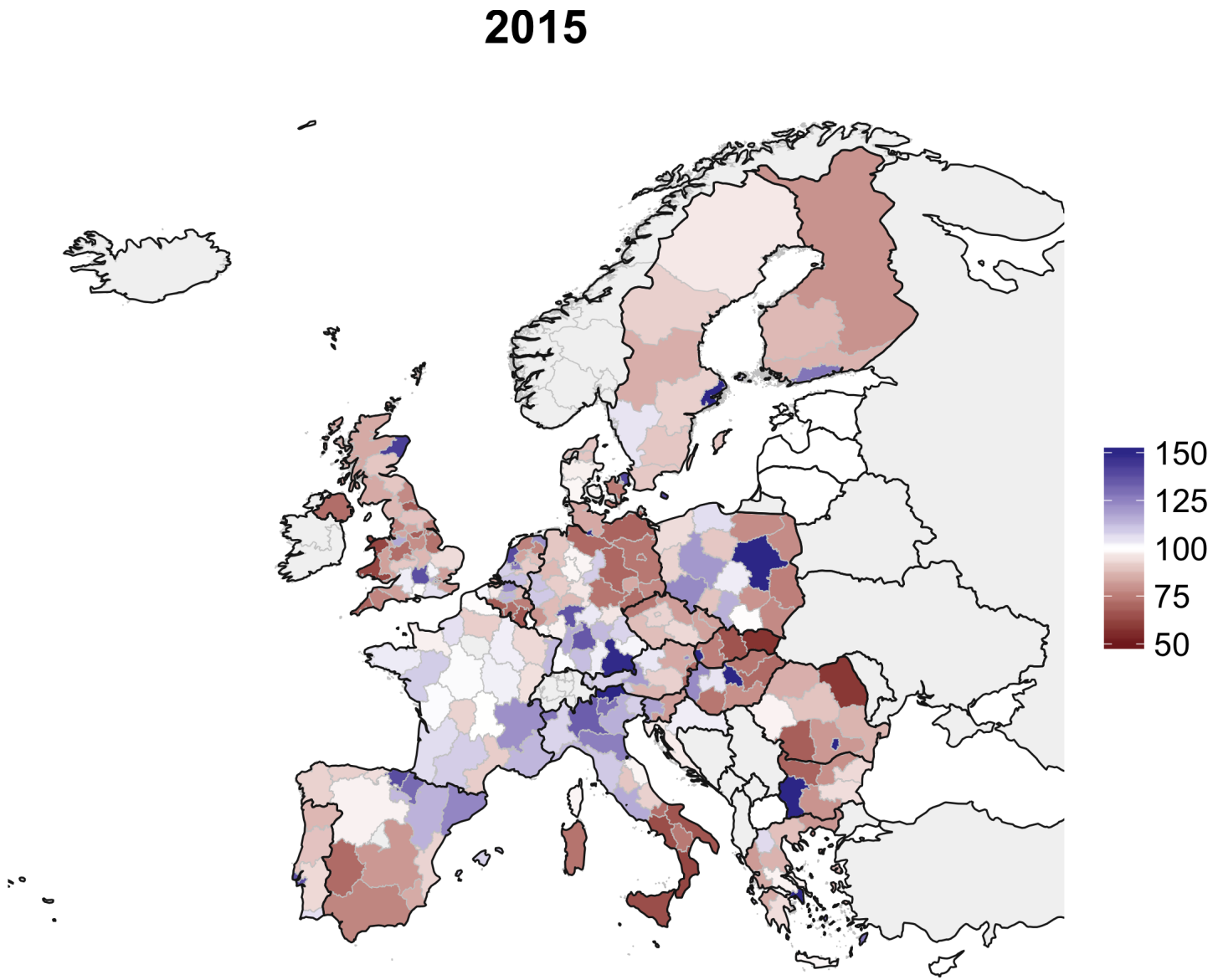
Stanford University
hlueders@stanford.edu

July 19, 2018

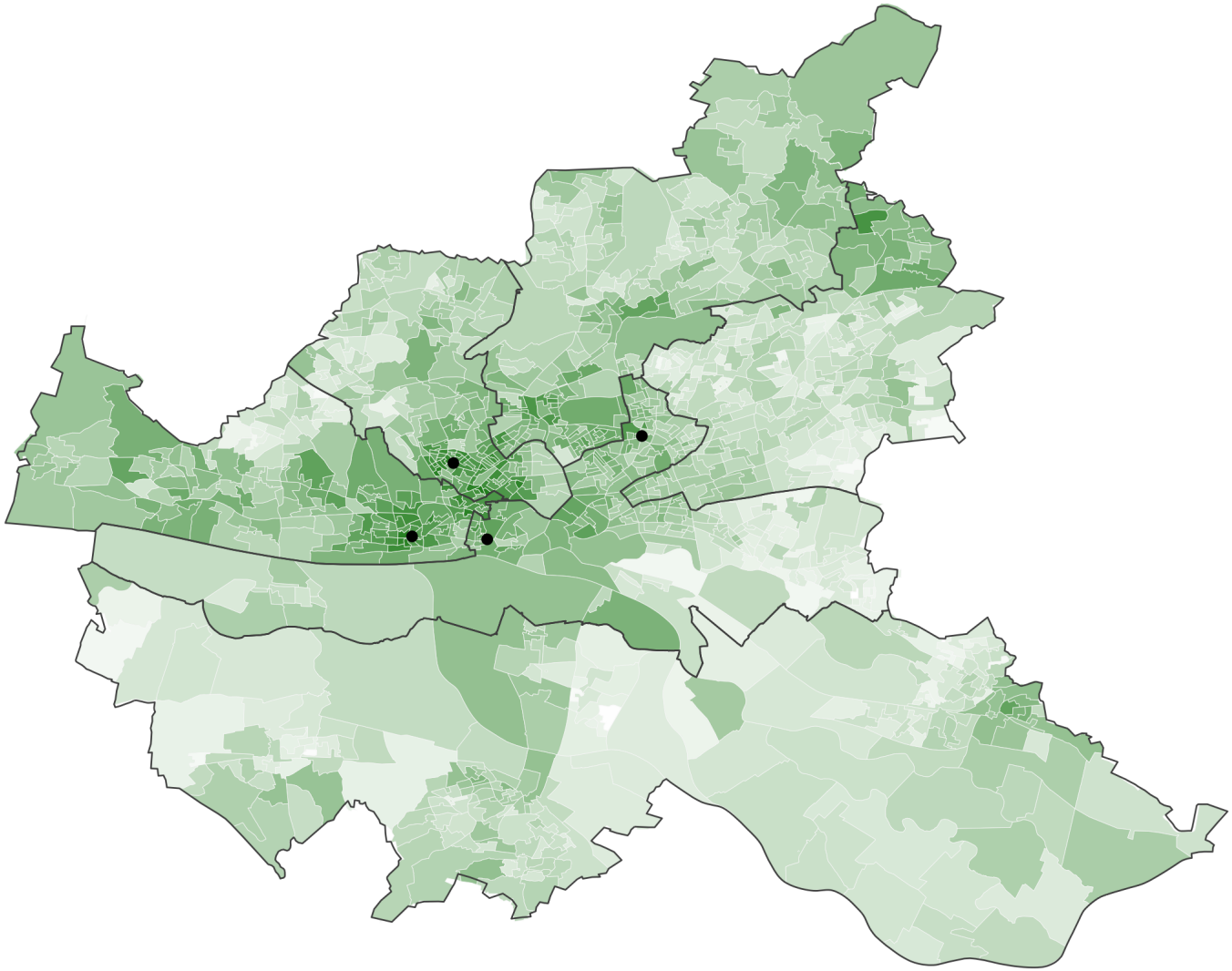
Why care?—Data visualization



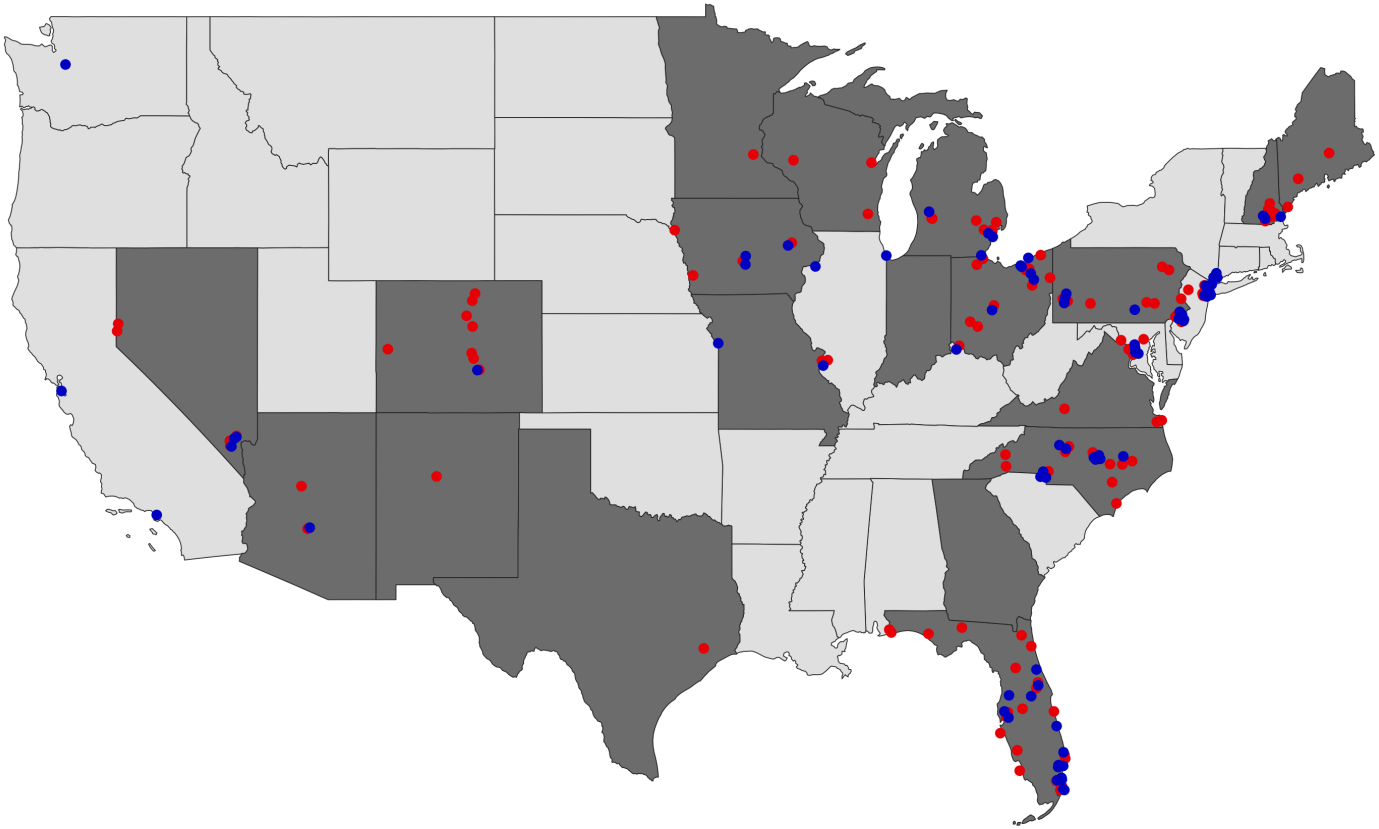
Why care?—Data visualization



Why care?—Data visualization



Why care?—Data visualization



Why care?—Data analysis

$\Downarrow$

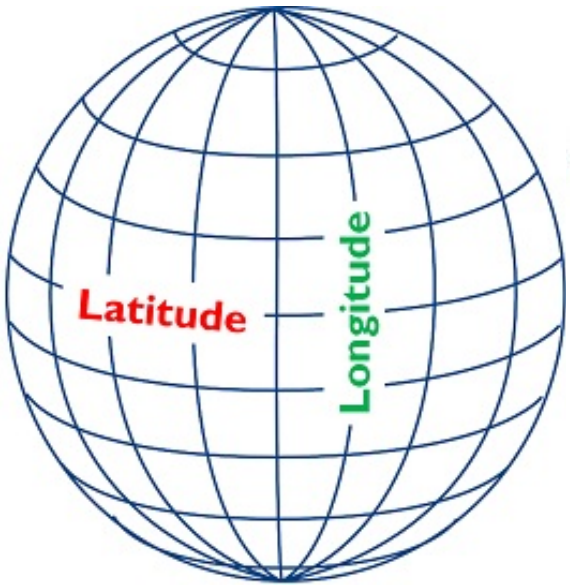
Merge geocoded information to data on speciifc geographic units (e.g., municipalities, counties, districts, regions, states, countries, ...)

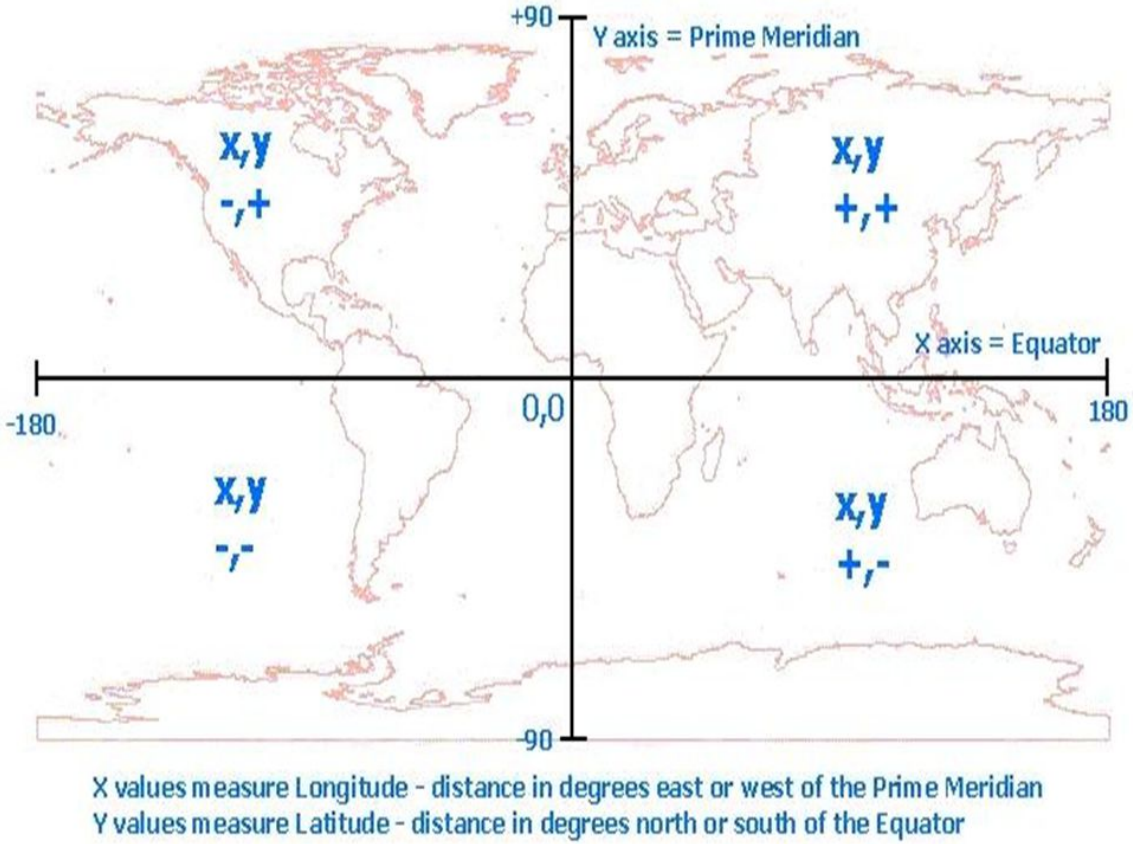
- What are the characteristics of municipalities targeted by political campaigns?
- What is the effect of campaign stops on turnout?
- Which city is closest to a particular point?
- Where do immigrants from a particular Mexican municipality typically move to in the US?
- What is the effect of climate change on domestic migration or political conflict?
- ...

Outline

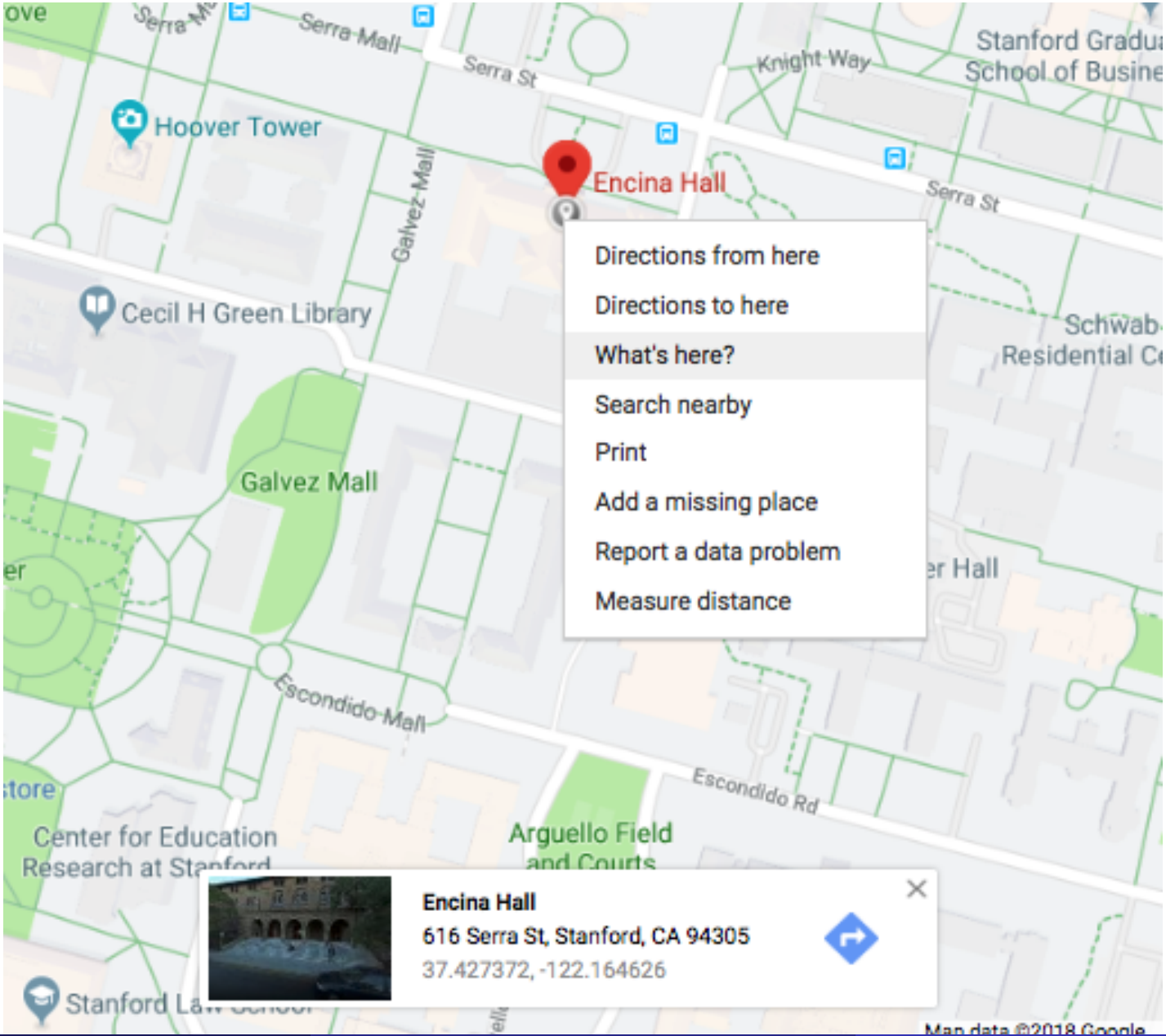
Outline

Longitude and Latitude

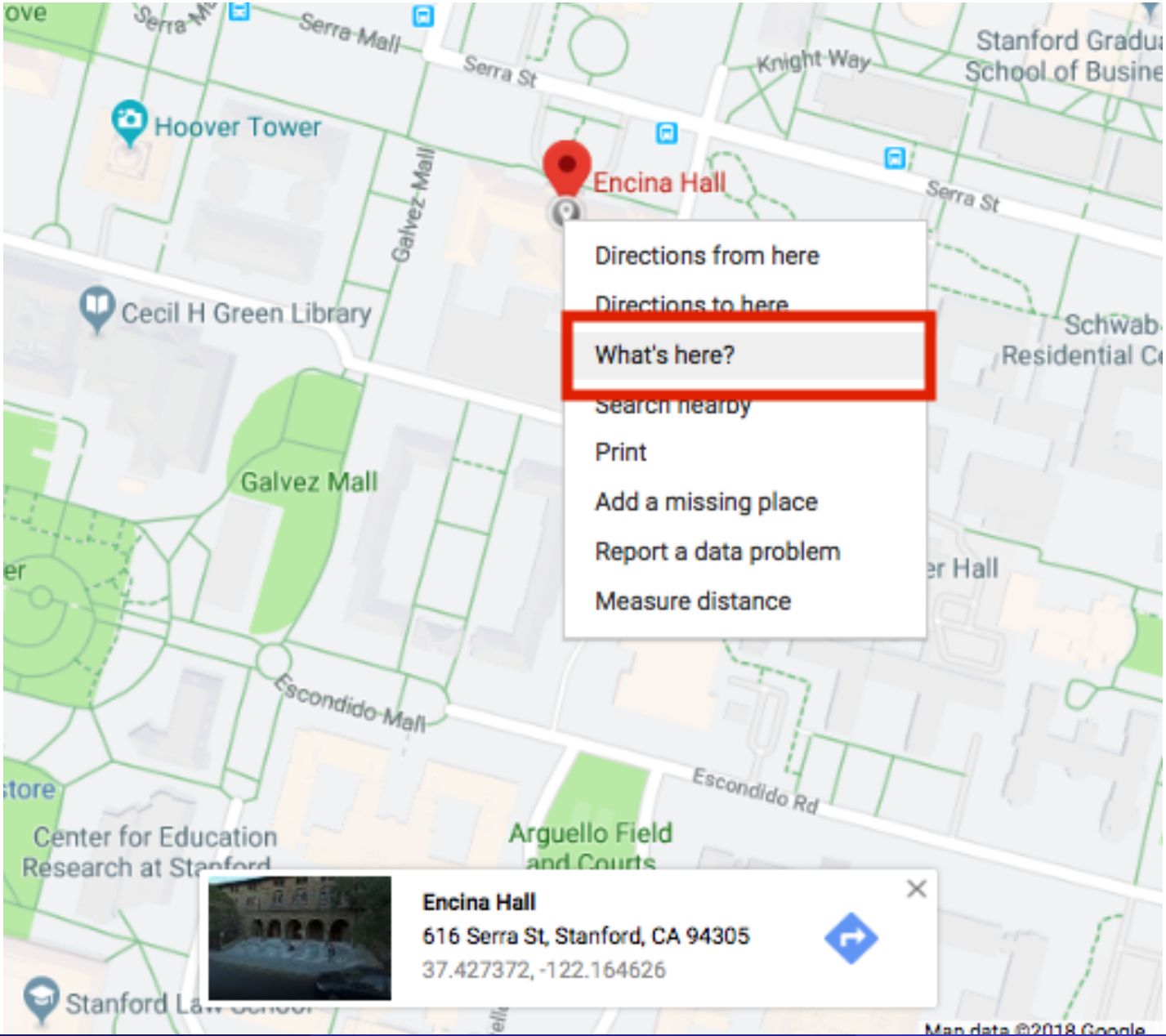




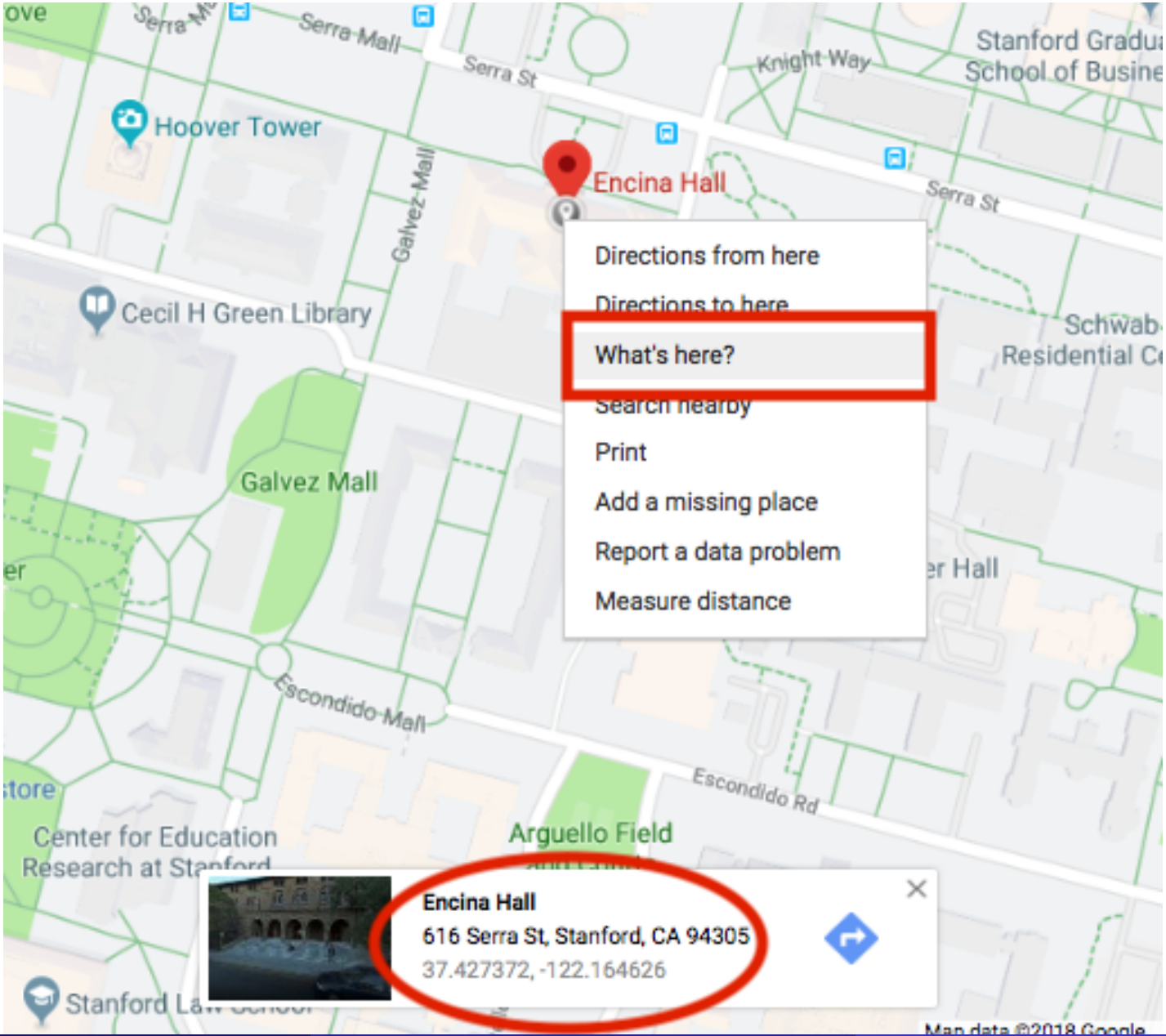
Getting geocodes on google maps



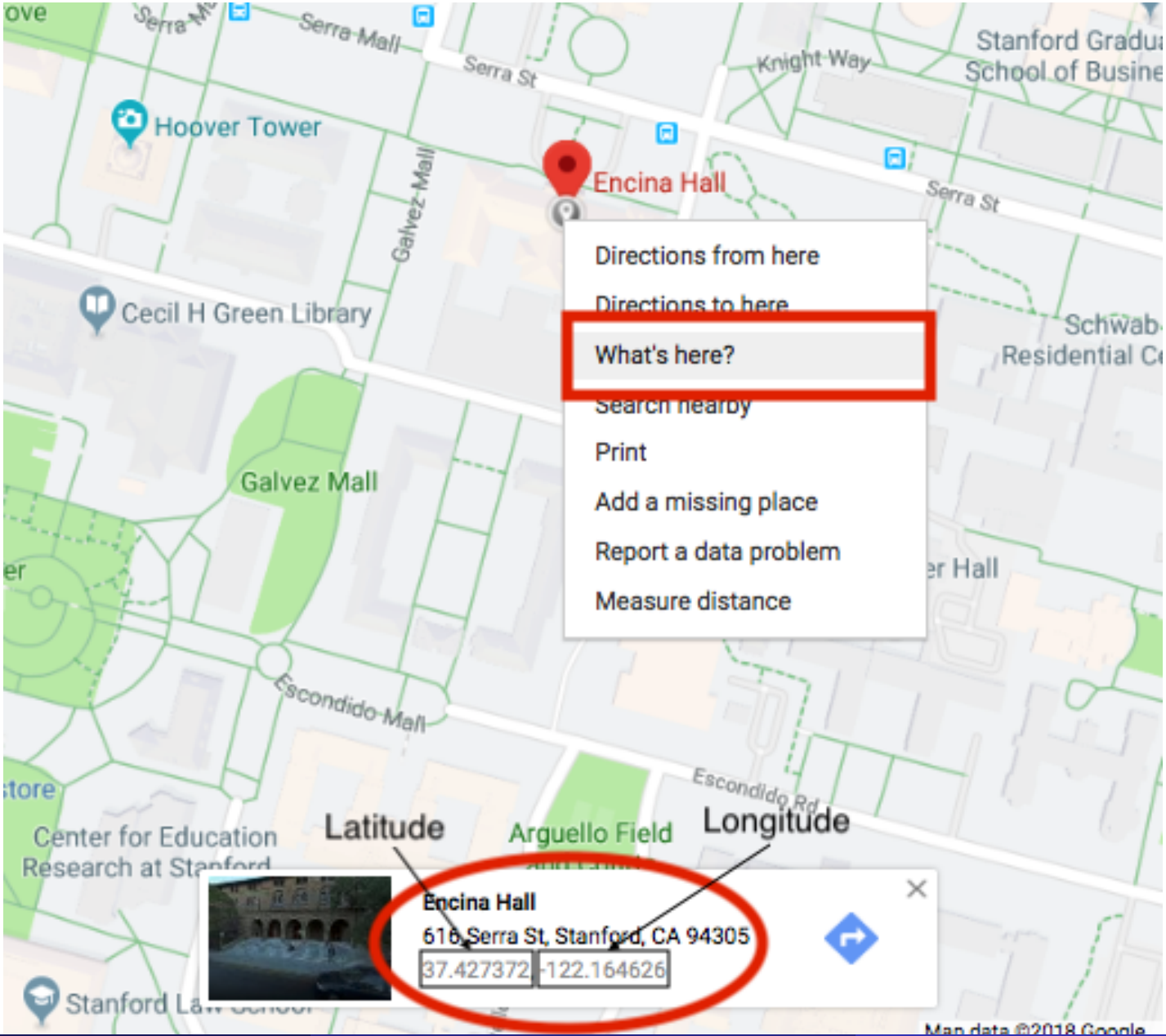
Getting geocodes on google maps



Getting geocodes on google maps



Getting geocodes on google maps



Outline

Geocoding using the Google API

Pros:

- Works worldwide
- Accepts any kind of location
  (i.e., full addresses, cities, counties, countries, ...)

Cons:

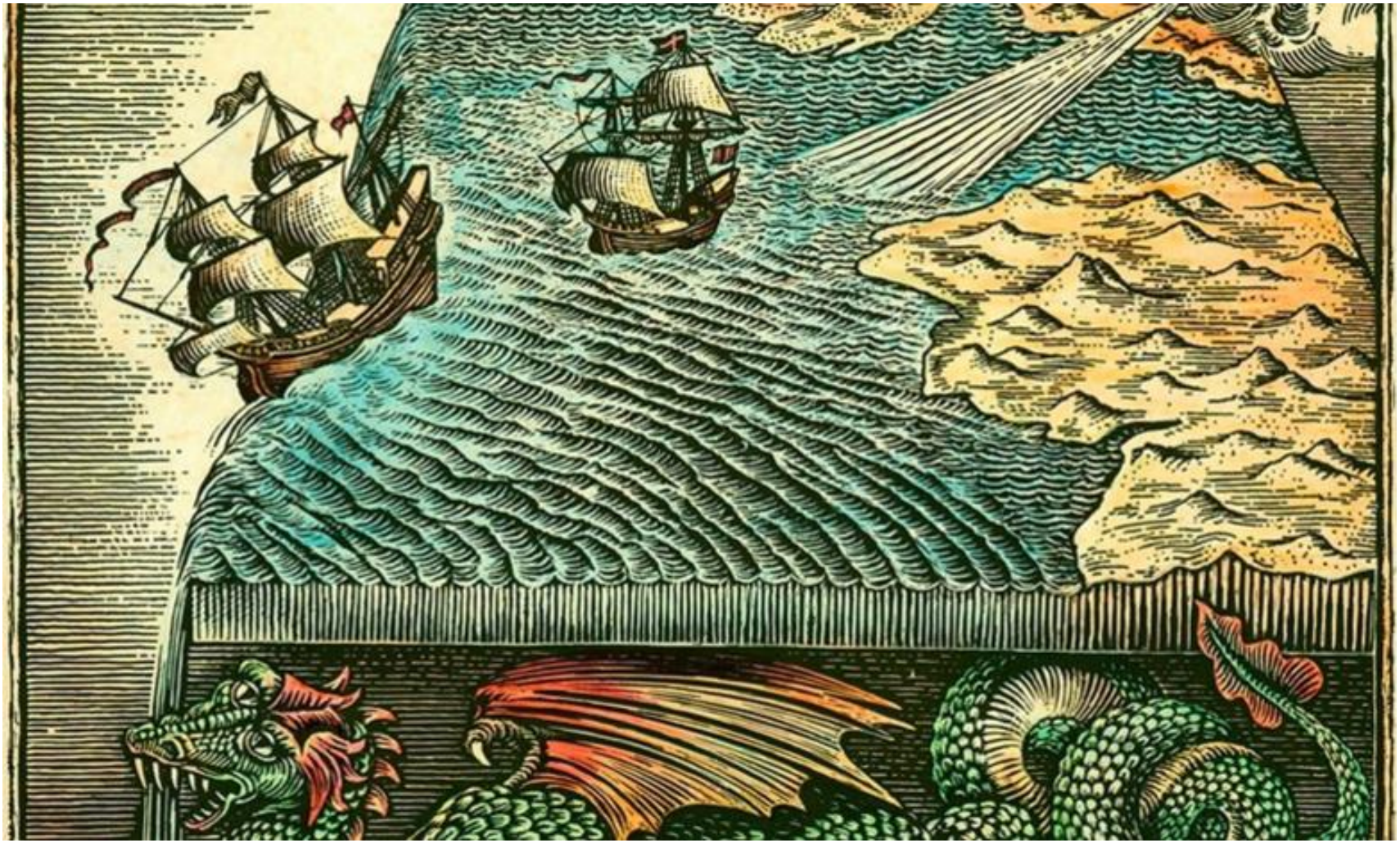
- Daily limits
- Still need to check quality of geocodes
- Quality decreases for more remote places

Let's do some geocoding!

R code

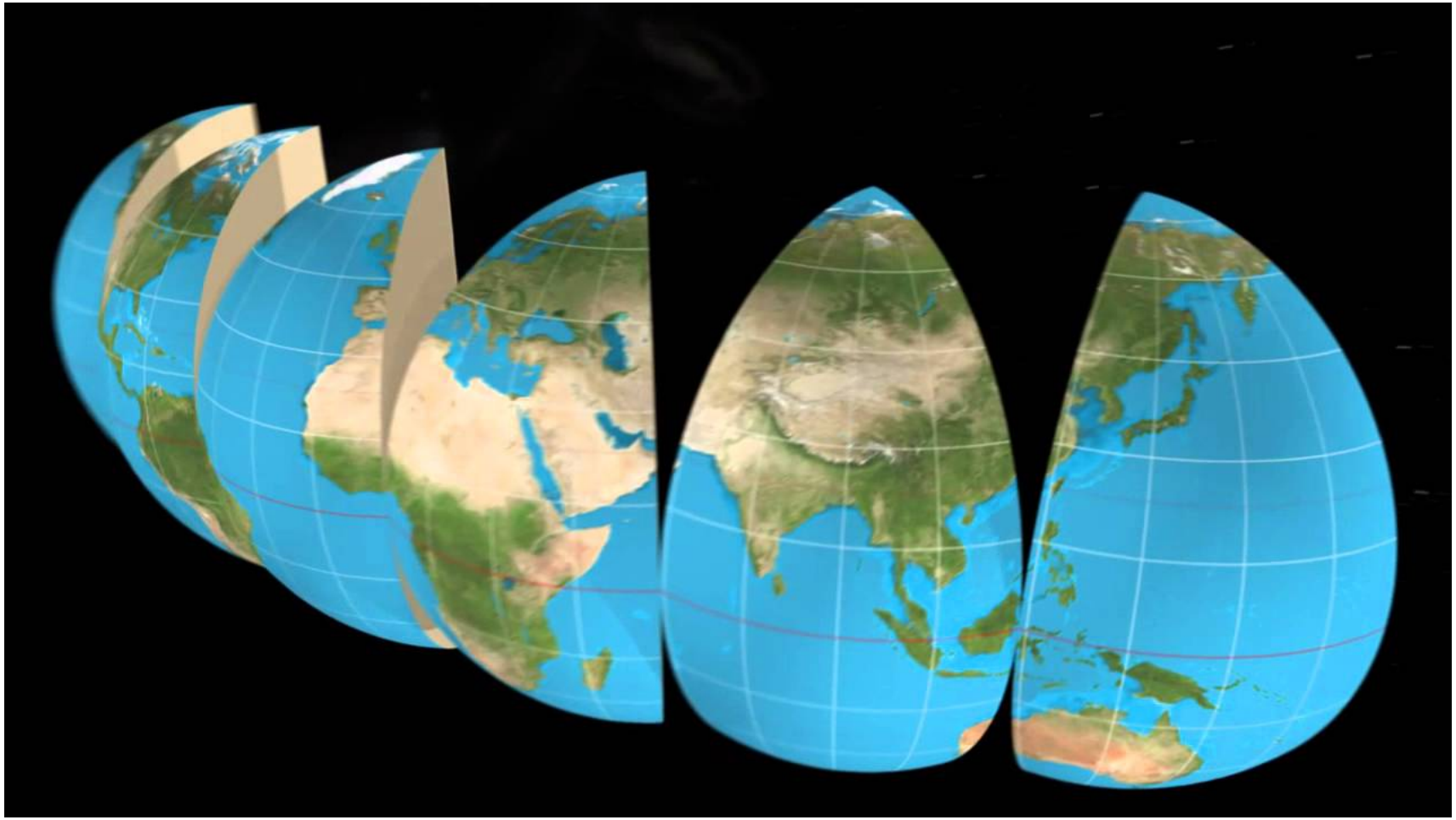
Outline

The Earth is *not* flat!

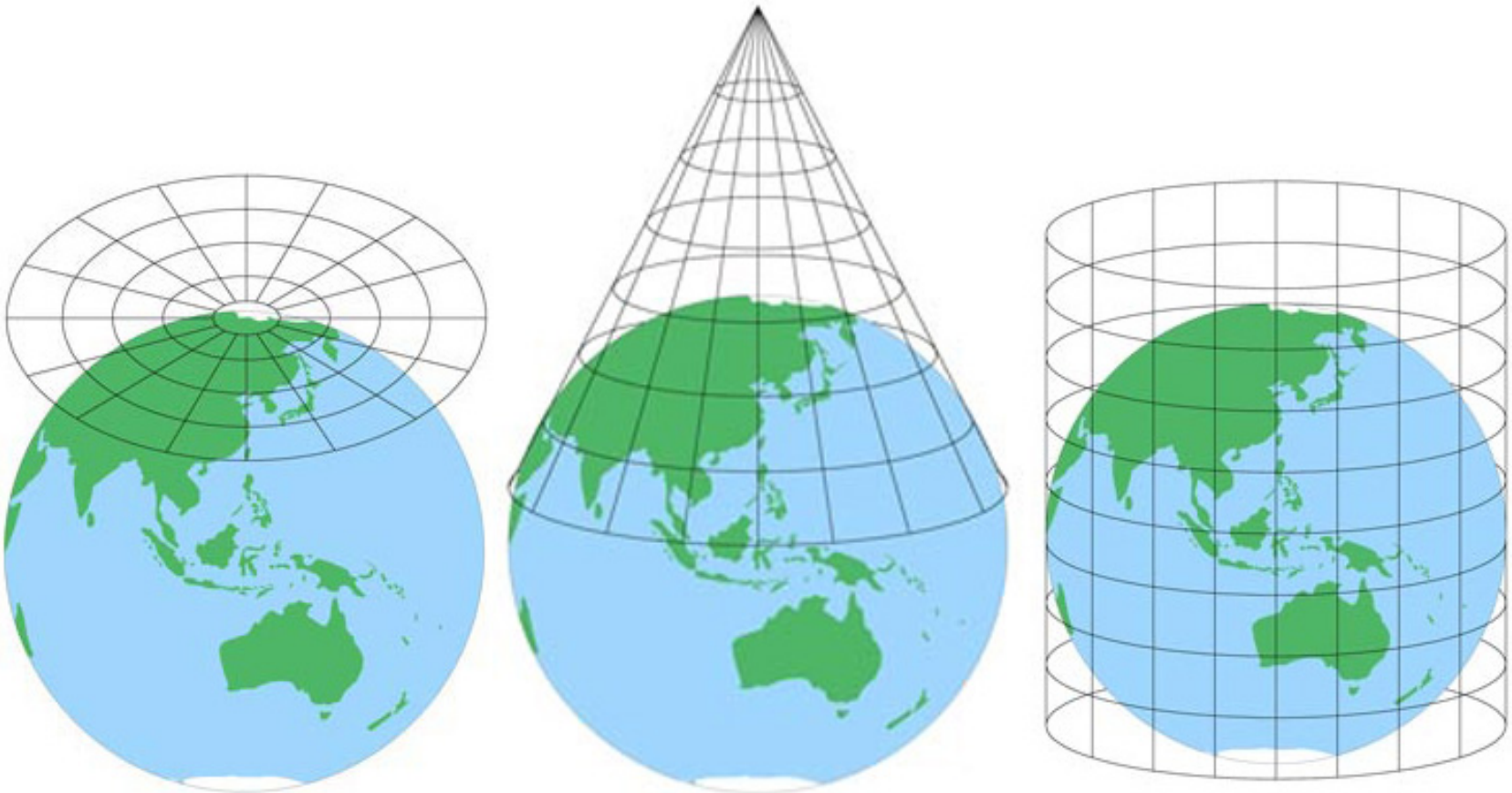


The Earth is *not* flat!

The Earth is *not* flat!



The Earth is *not* flat!

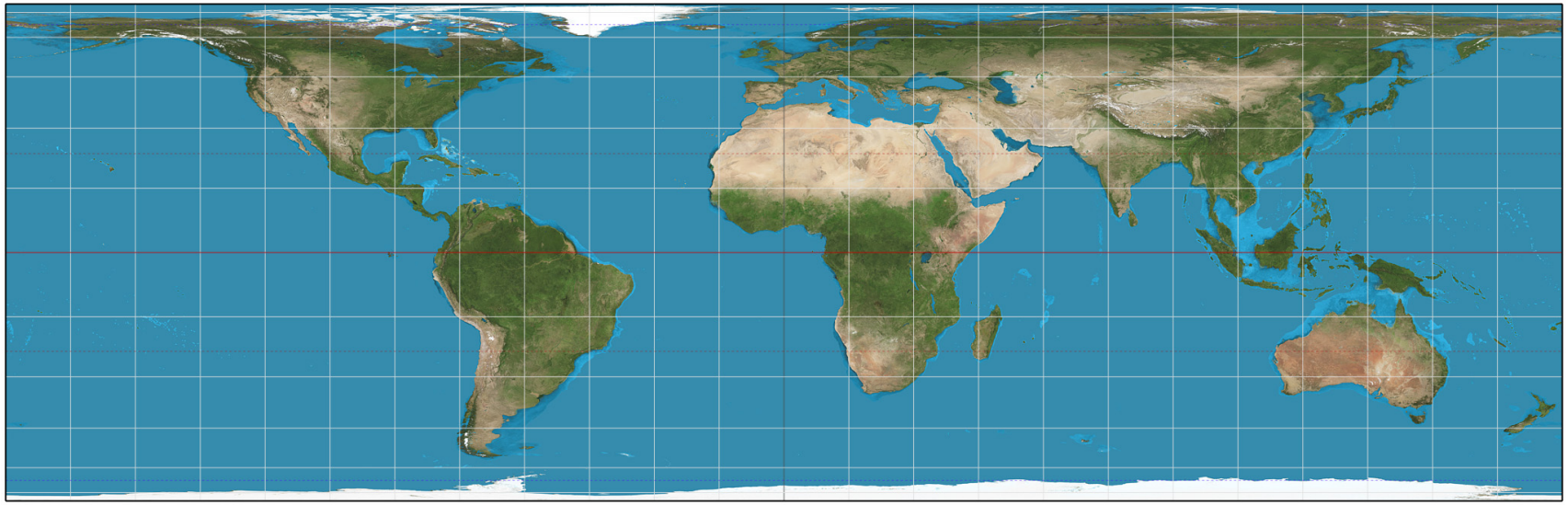


Mapping is Politics

Mercator Projection

Mapping is Politics

Lambert Projection

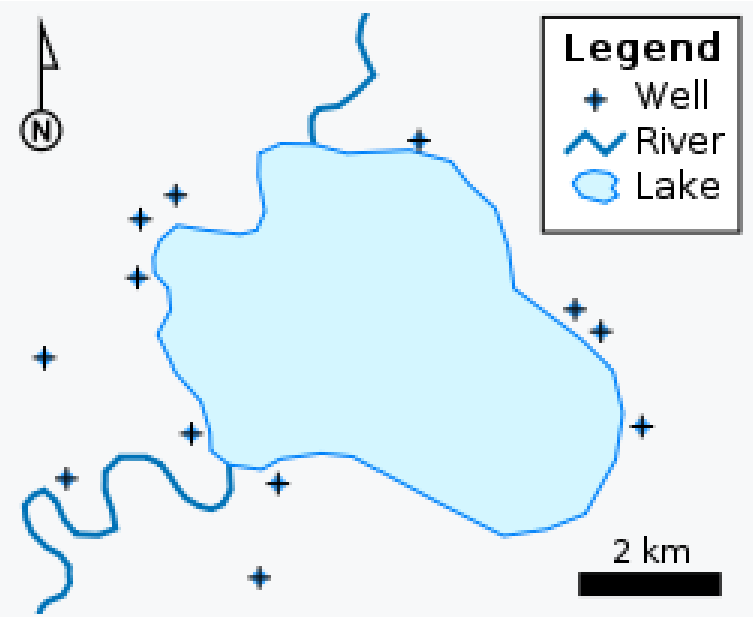


Coordinate Reference Systems (CRS)

- Also called Spatial Reference System (SRS)
- Coordinate-based local, regional, or global system used to locate geographical entities
- Defines a specific map projection
- Important to know when joining different shapefiles or geocoded points onto maps
- Google maps uses the Mercator projection based on WGS84 (W[orld] G[eodetic] S[ystem] 1984)

GIS data

- GIS: Geographic information systems
- Storage of a variety of geographic information:
  - Points (e.g., Encina Hall)
  - Lines (e.g., Serra St)
  - Polygons (e.g., Santa Clara county)



A vector map, with points, polylines and polygons

GIS data

- Data
  - Shape file (.shp): vectorized geographic coordinate ("shape") data (points, lines, polygons)
  - Shape index (.shx): positional index of the feature geometry to allow seeking forward and backward quickly
  - Data frame (.dbf): information associated with each point, line, or polygon
  - Projection info (.prj): contains projection data and information on the CRS used

Outline

Let's do some mapping!

R code

Outline

Let's use some of the GIS tools for actual analyses!

R code

Outline

Some useful online resources

- Nick Eubank's GIS in R scripts
- Making Maps with R
- Natural Earth Data shapefile collection
- Colors in R
- Color Brewer Advice for Cartography

Thank you!

For questions, please reach out to

`hlueders@stanford.edu`