



# Data Visualization

Qi Sun

[qisun@nyu.edu](mailto:qisun@nyu.edu)

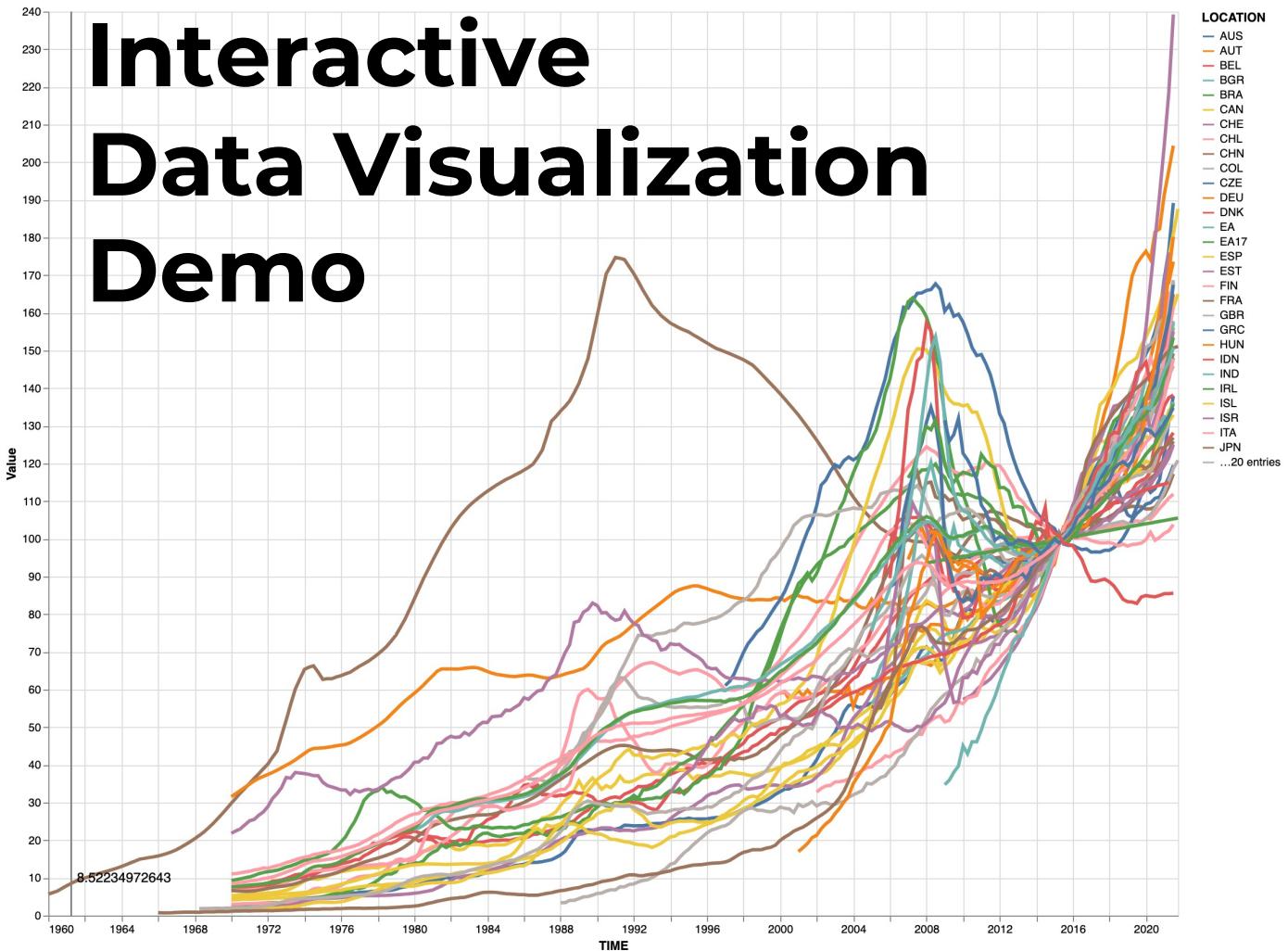
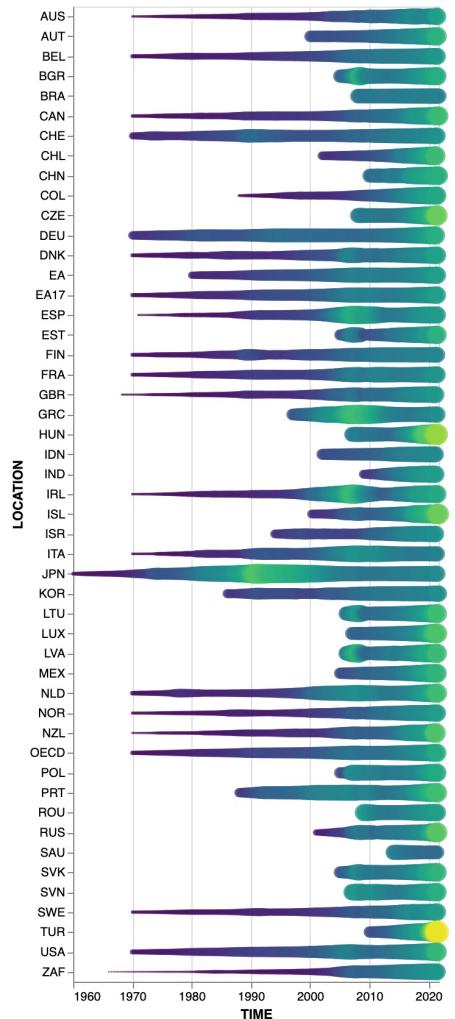
CUSP – GX 6006 A

P A R T 0 1

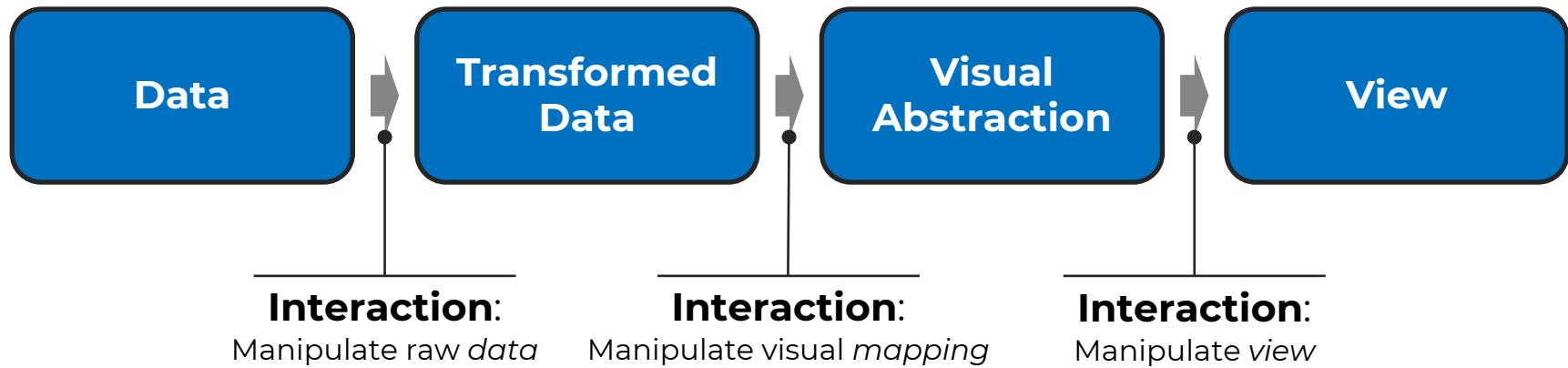
---

# Interactivity

# Interactive Data Visualization Demo



# Visualization Pipeline

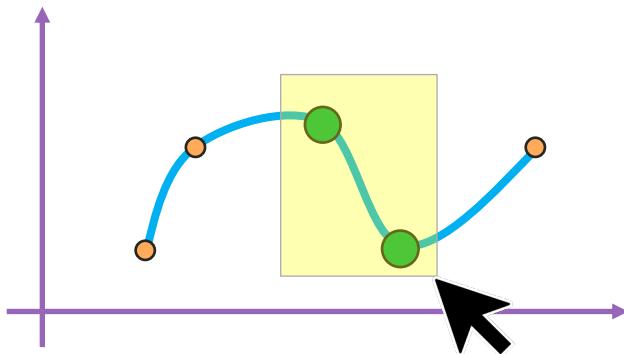


# Why Interaction?

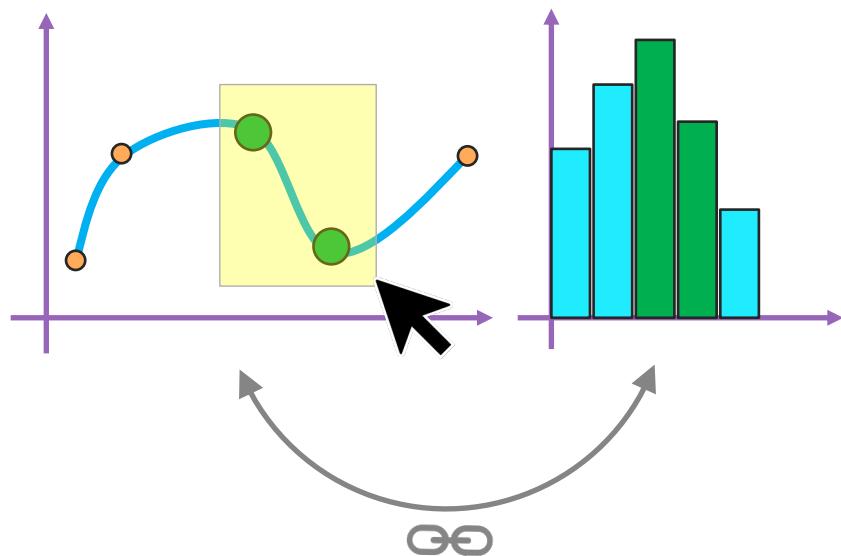
- It is often impossible to visualize in a single static view **all the information** needed to answer **all the questions** at once.
  - Too much information.
  - Need adaption for multiple questions.
- As a general-purpose application for data analysis and exploration.

# Single View vs Multi View

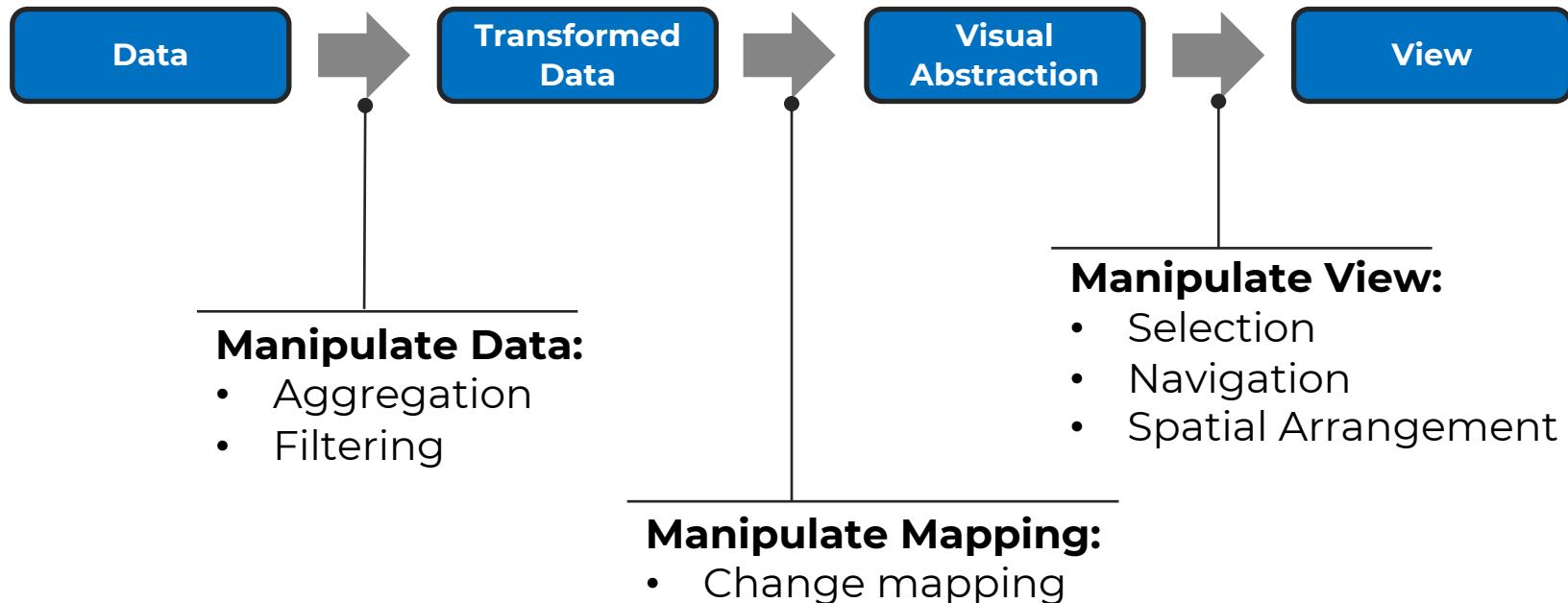
Single View

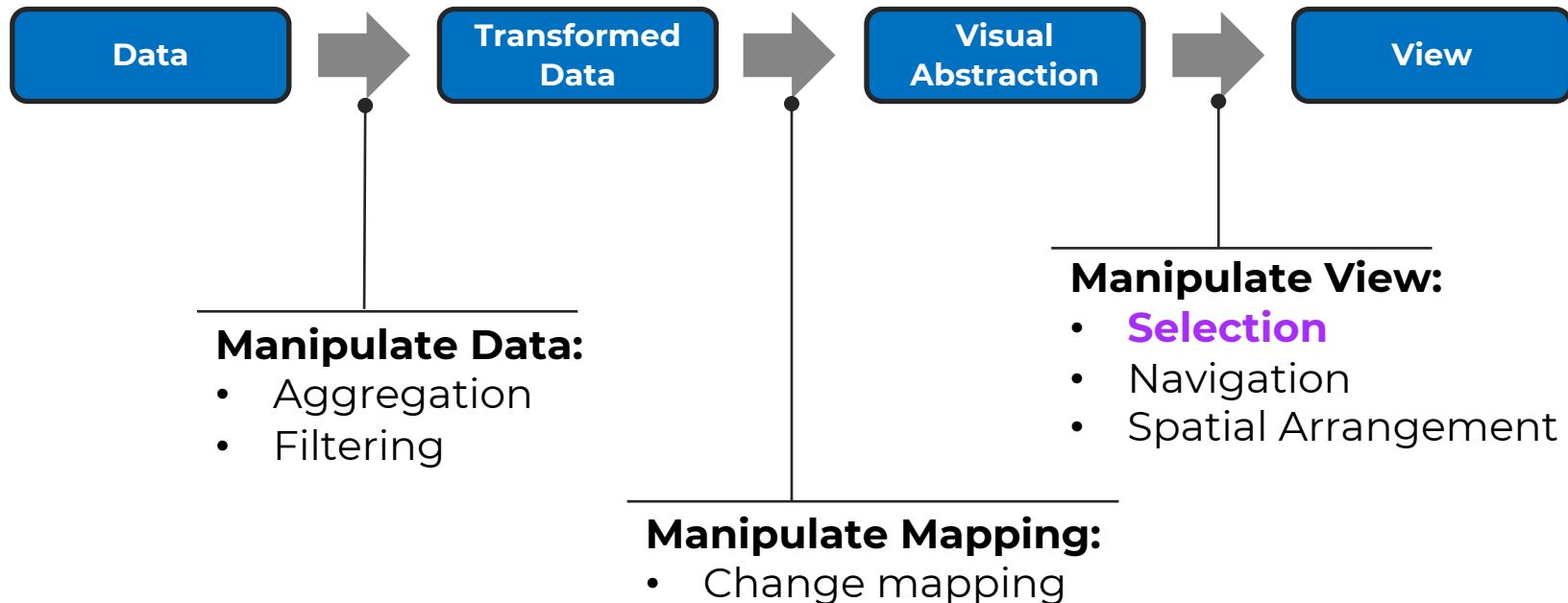


Multiple Linked View



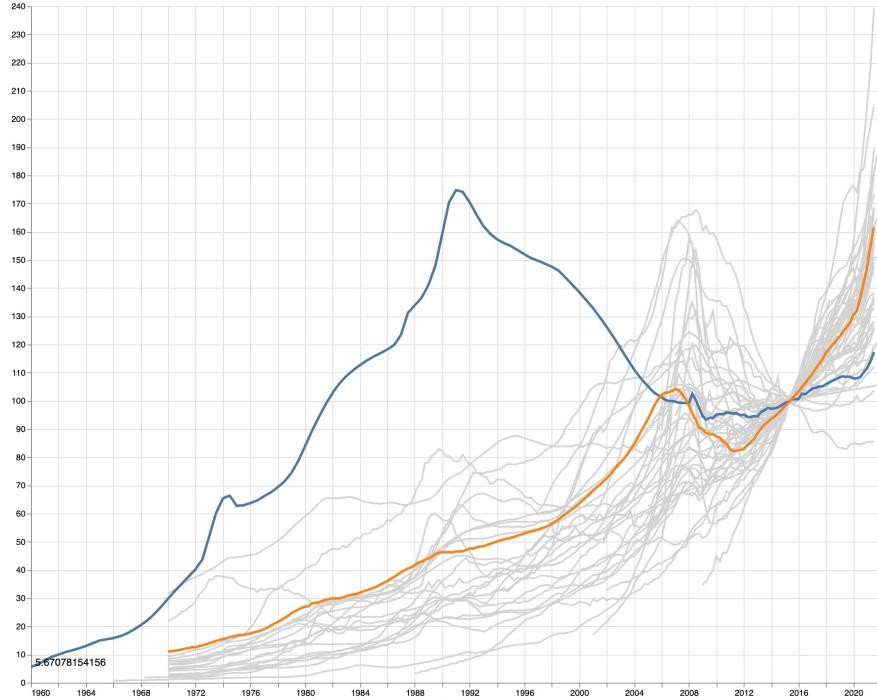
# Single View Methods



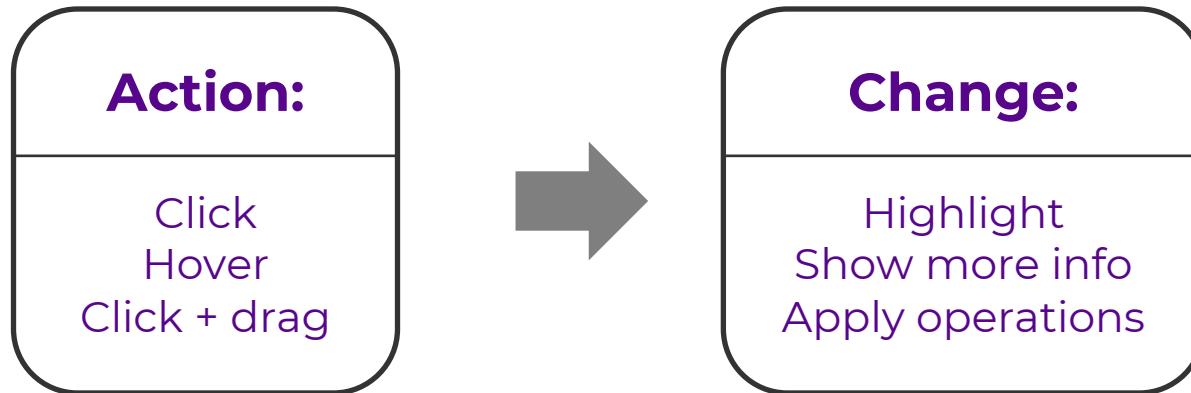


# Selection

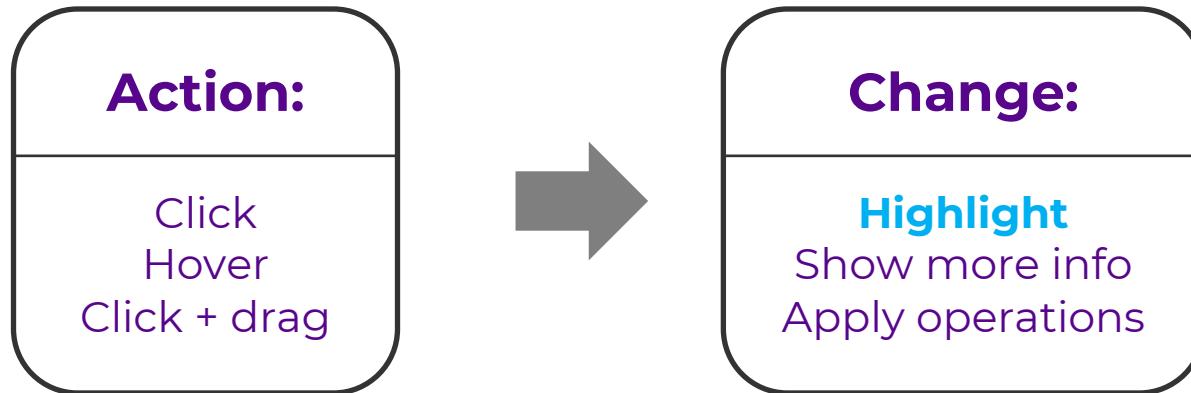
Any action aimed at selecting one or more elements of the visualization.

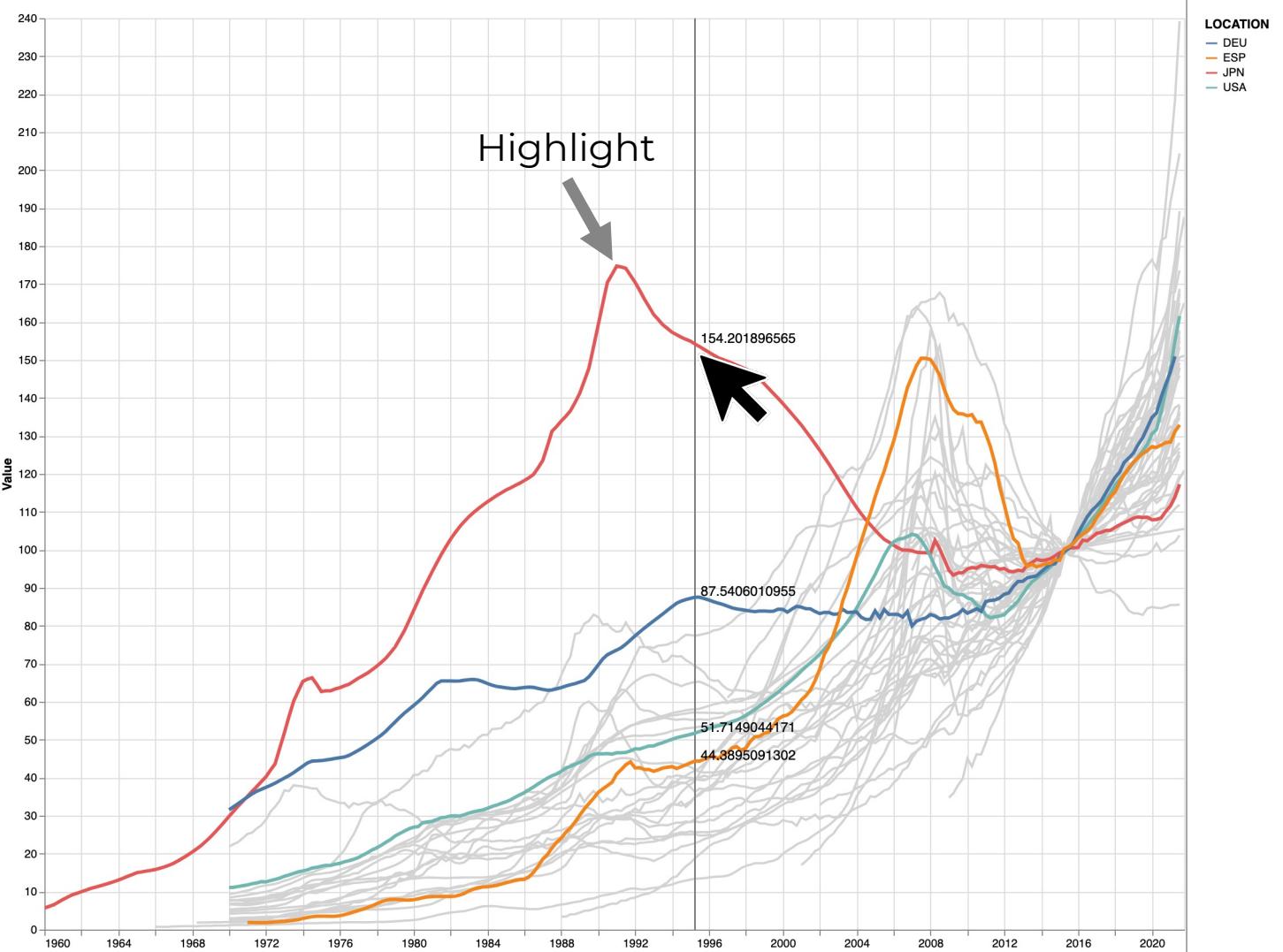


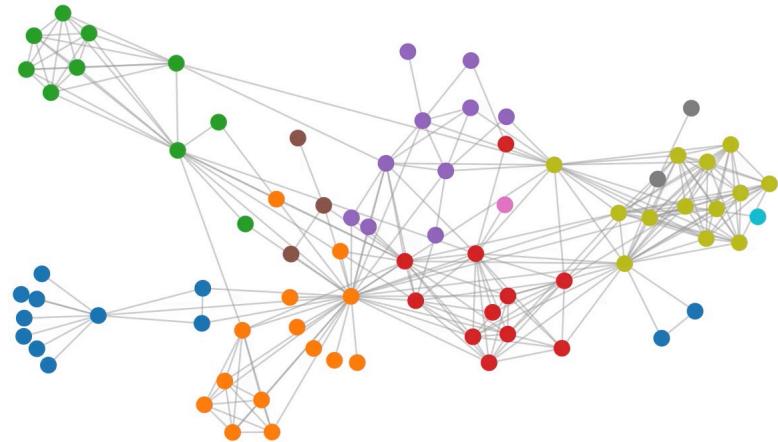
# Selection



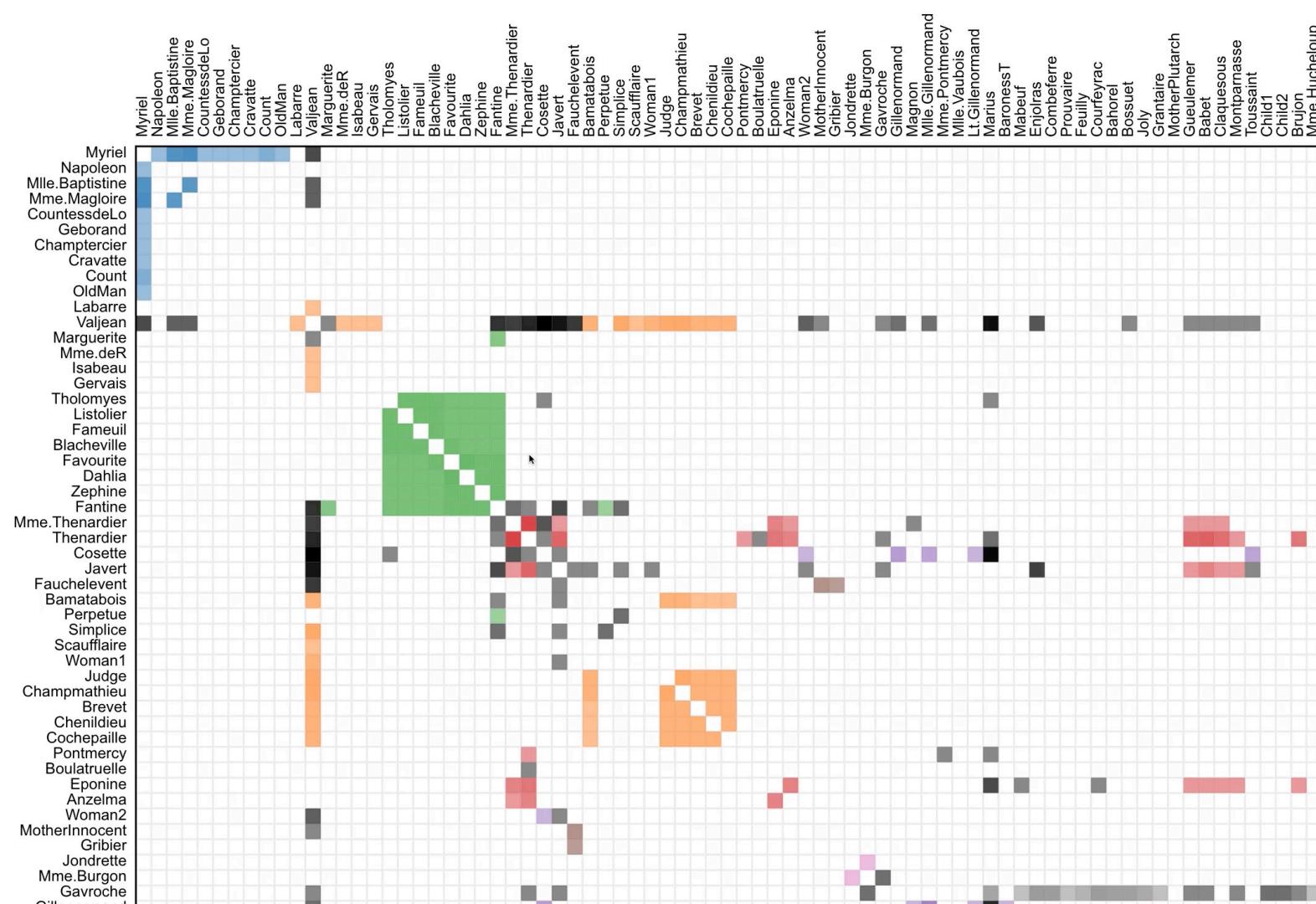
# Selection





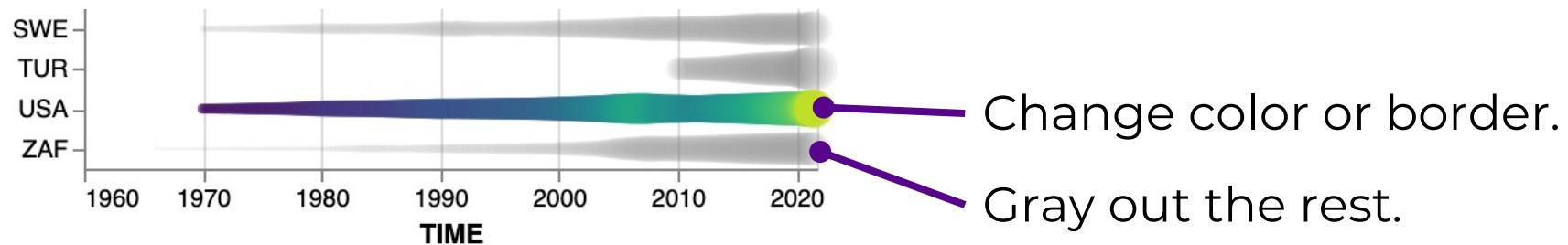


Source: Enrico Bertini

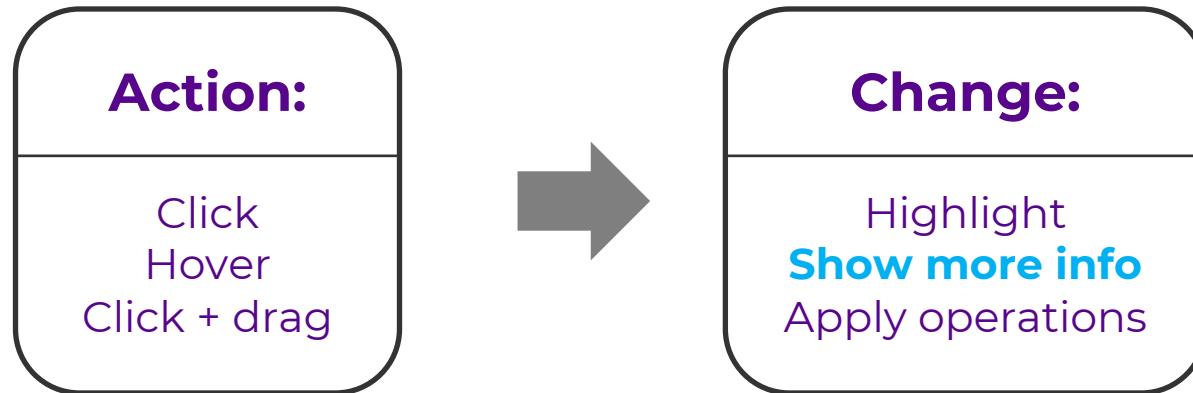


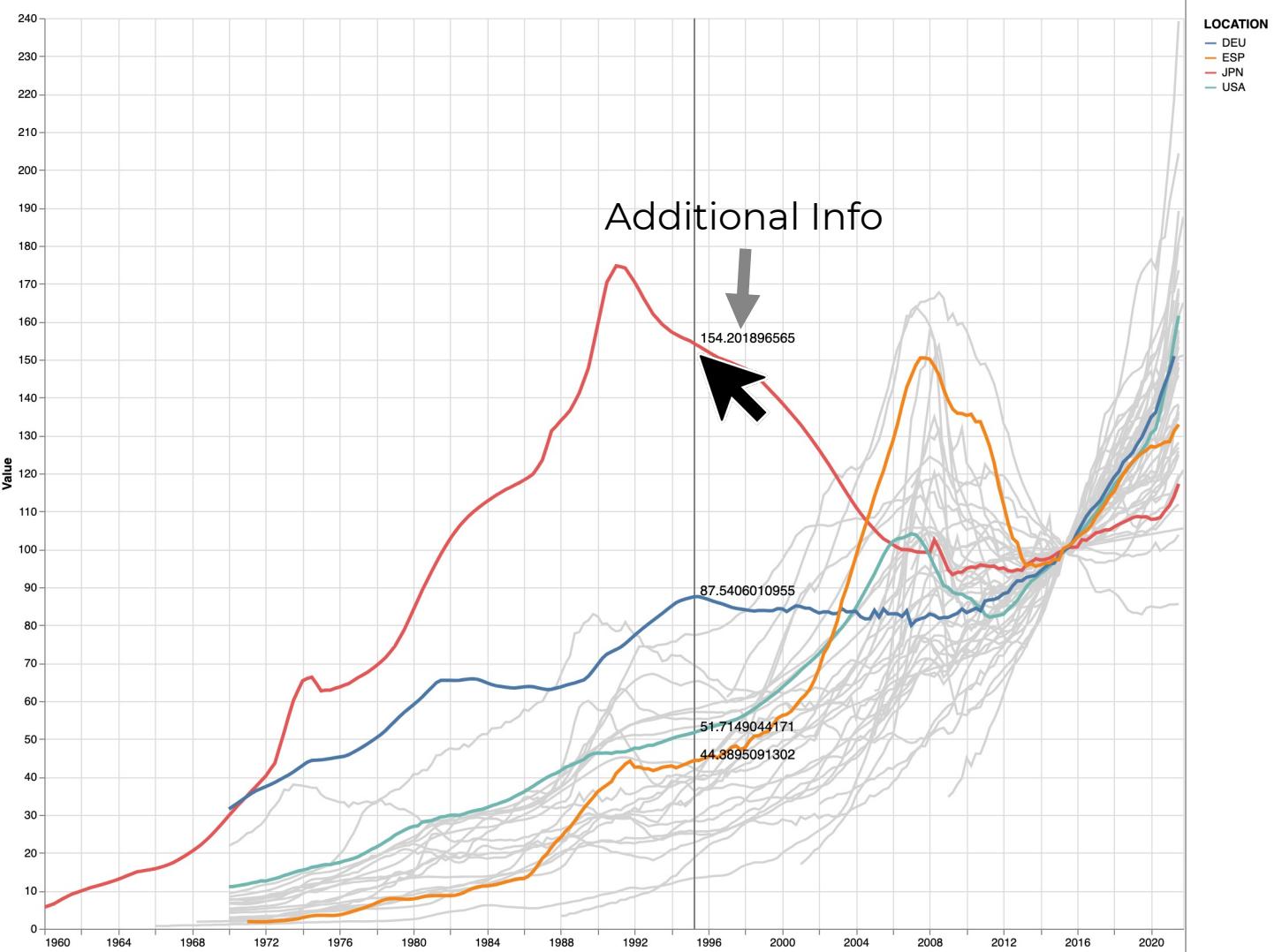
Source: Enrico Bertini

# Highlight Strategy



# Selection

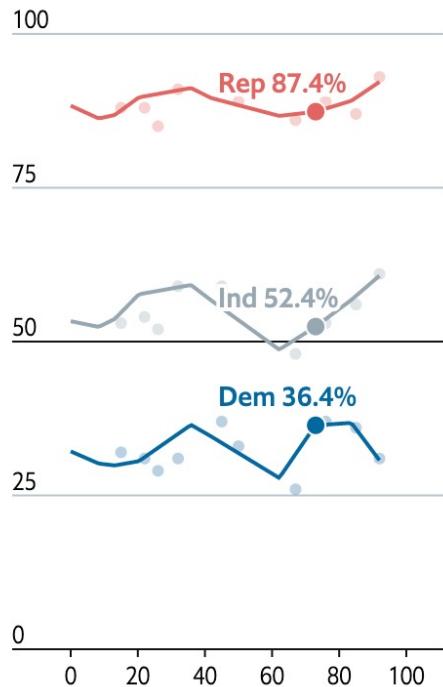




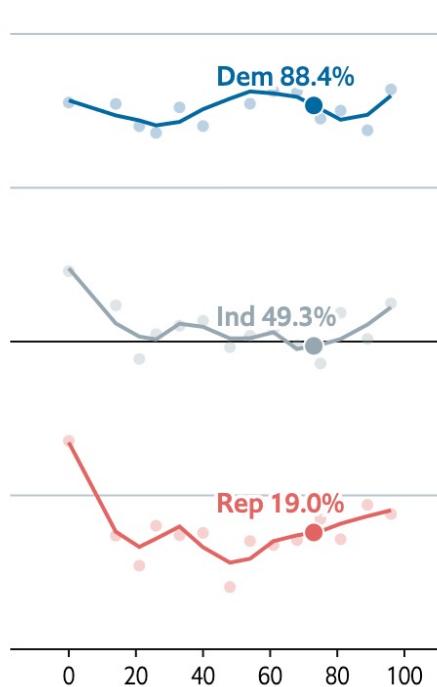
## Presidential approval per party leaning during first 100 days, %

● Democrat ● Republican ● Independent

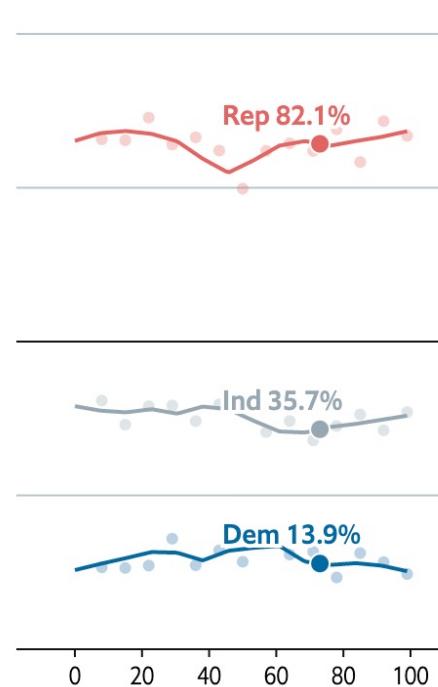
George W. Bush



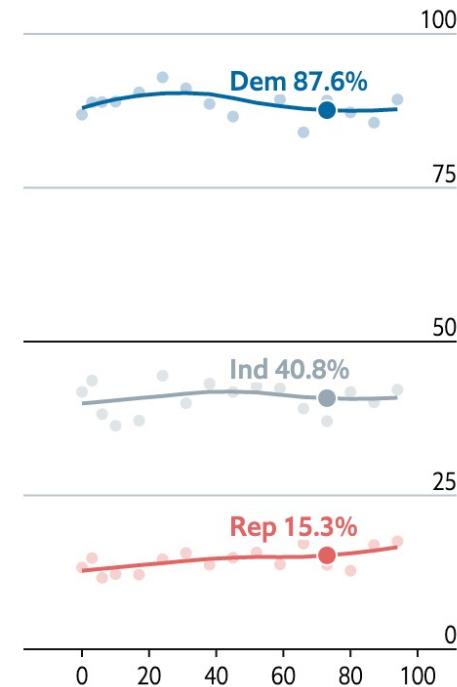
Barack Obama



Donald Trump



Joe Biden

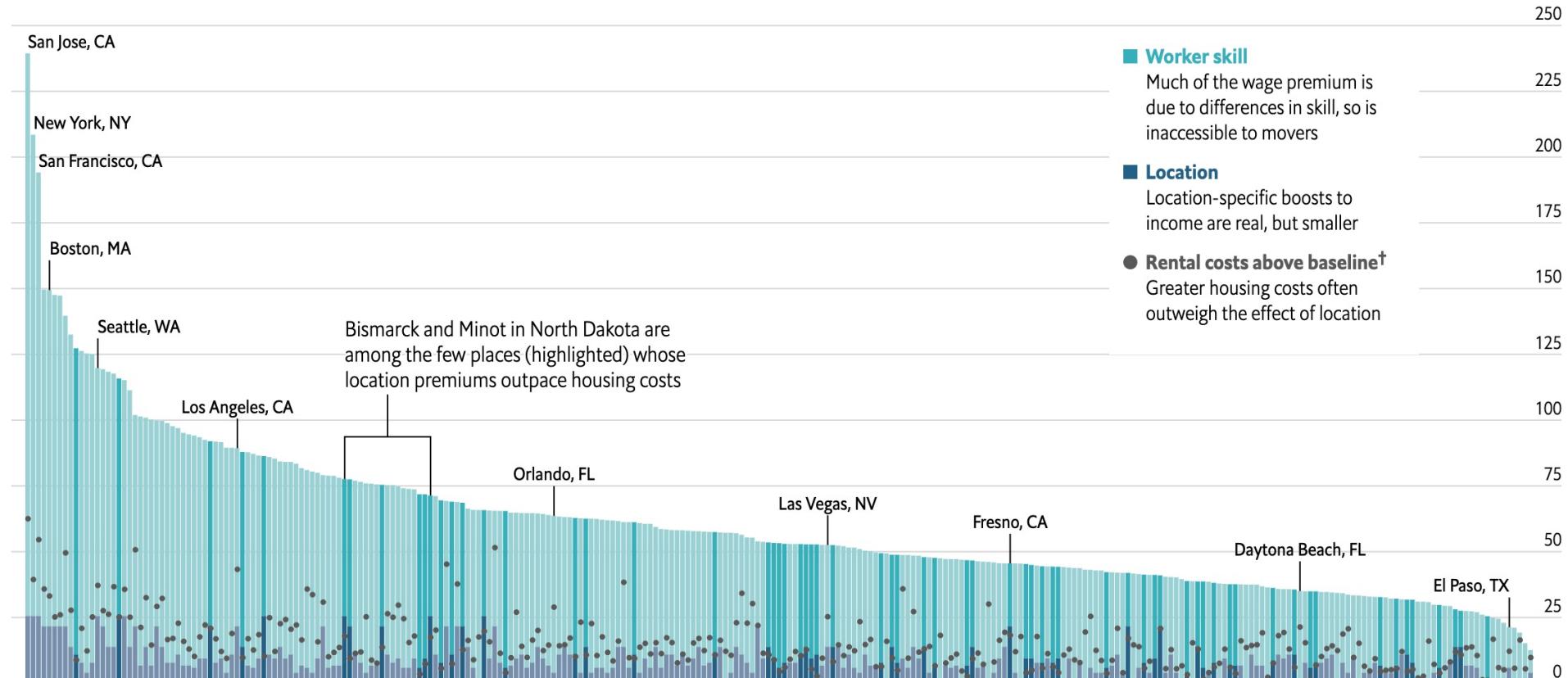


Sources: Gallup; YouGov/The Economist

Source: <https://www.economist.com/tracking-joe-biden>

Average wage, % above baseline\*  
American commuting zones, 2010-18

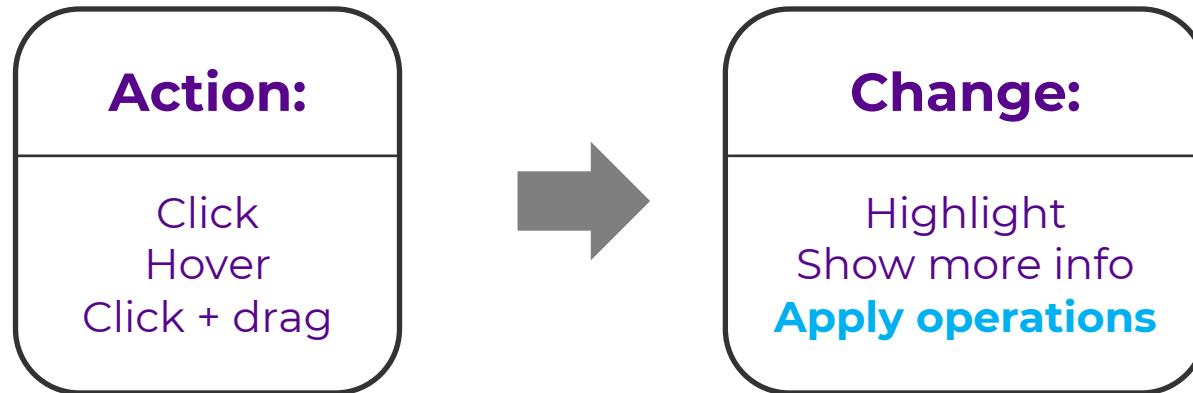
Choose a city ▾



\*\$25,000 per year in 2015 dollars †Above \$4,500 per year, as a proportion of baseline wages

Source: <https://www.economist.com/graphic-detail/2022/01/15/why-north-dakota-not-new-york-may-be-the-land-of-opportunity>

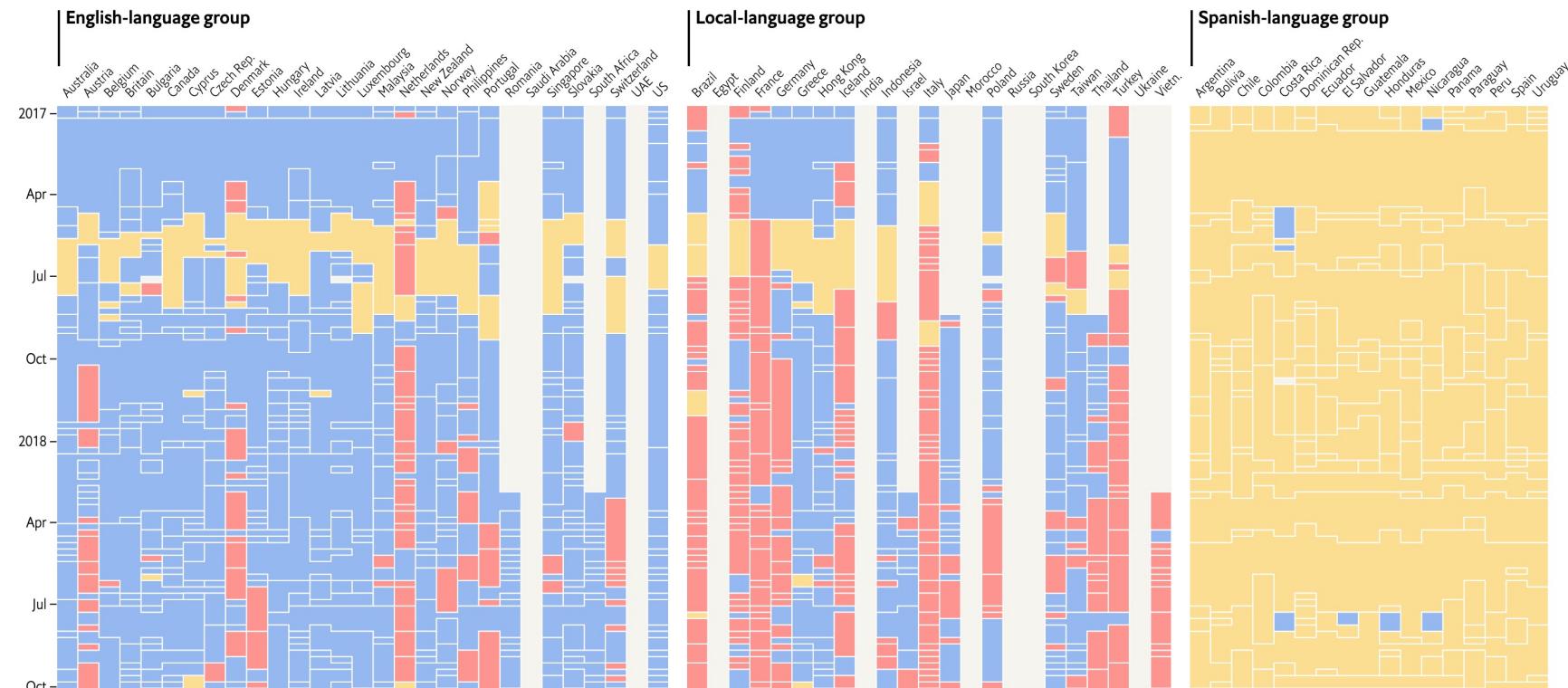
# Selection

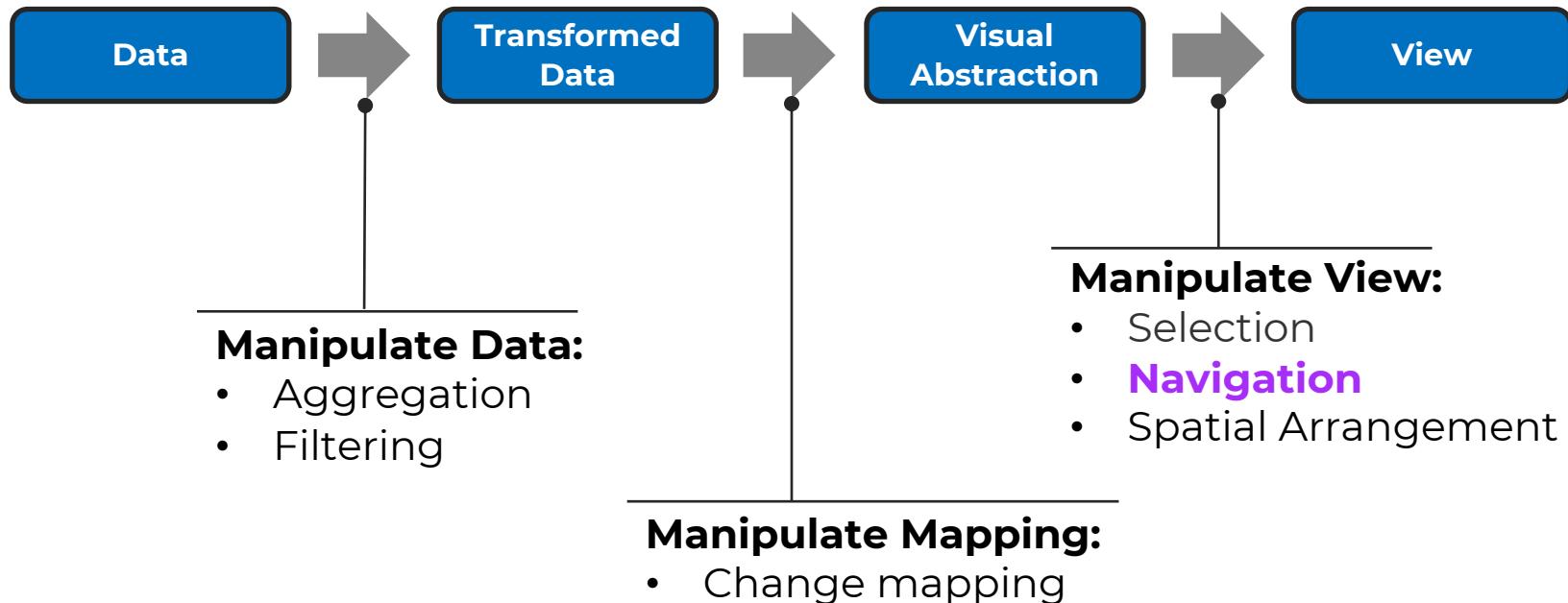


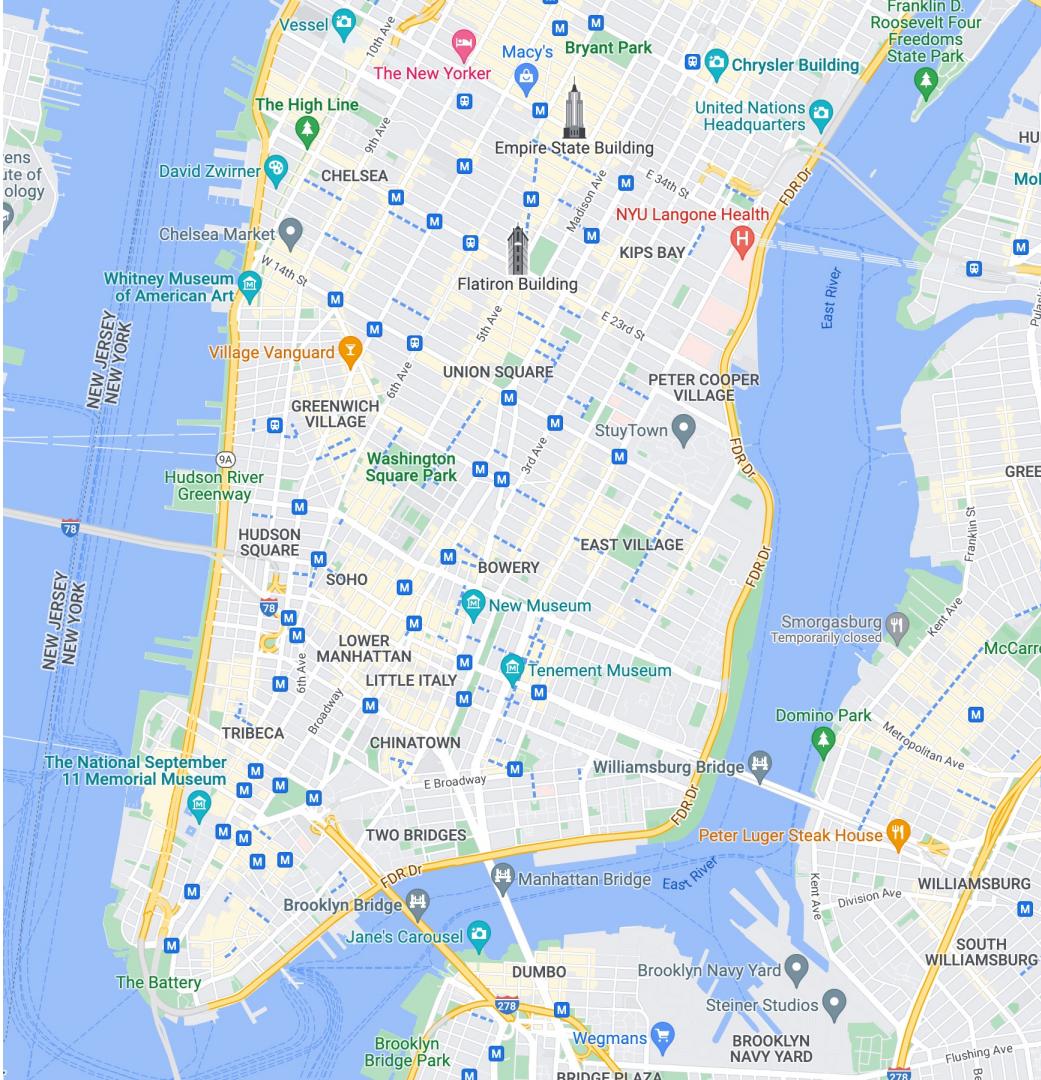
## Most streamed song on Spotify in each week, by language

ⓘ Hover to see song. Click to listen

English    Spanish    Other    No data

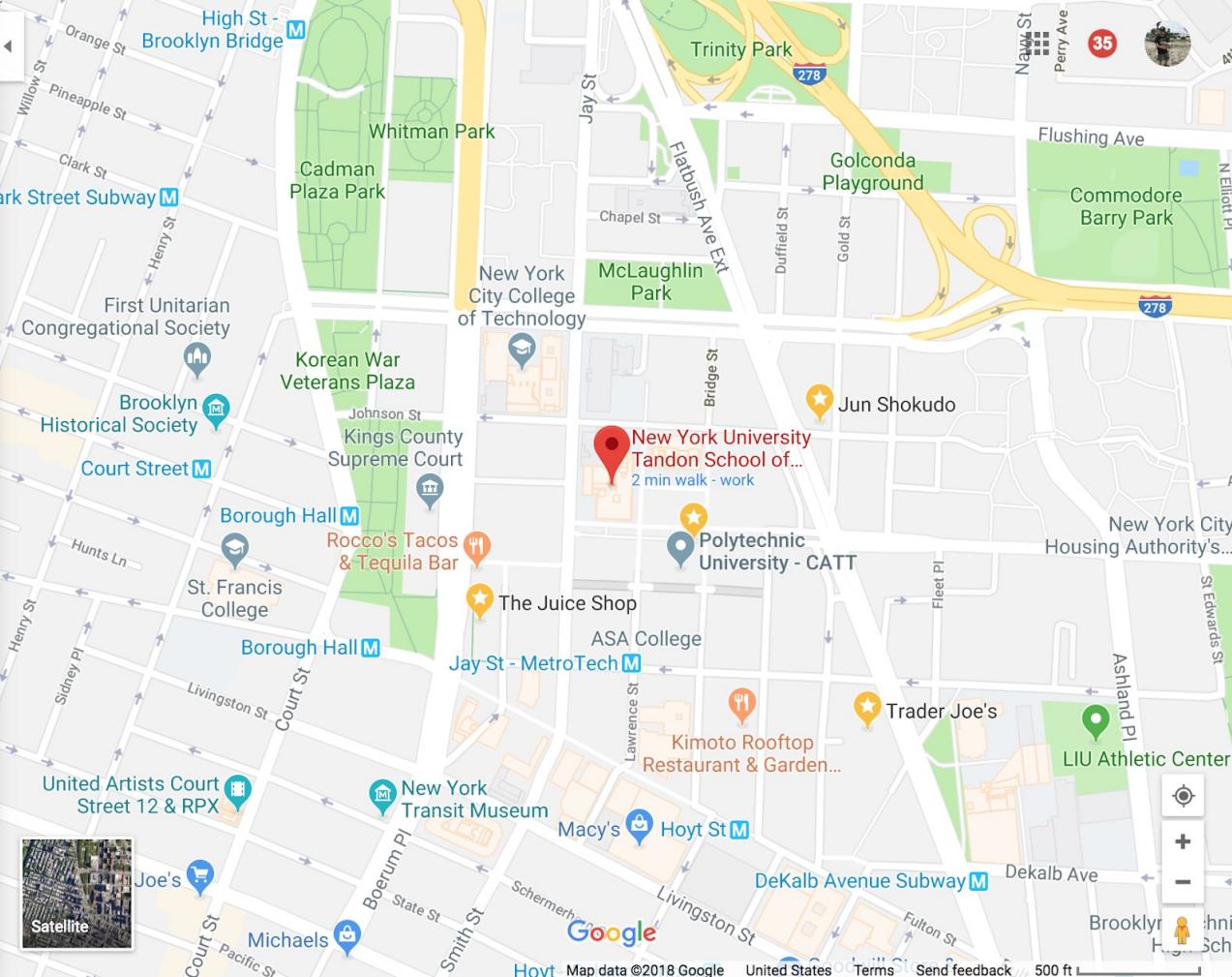






Source: Google Map

# Semantic Zooming



Source: Google Map

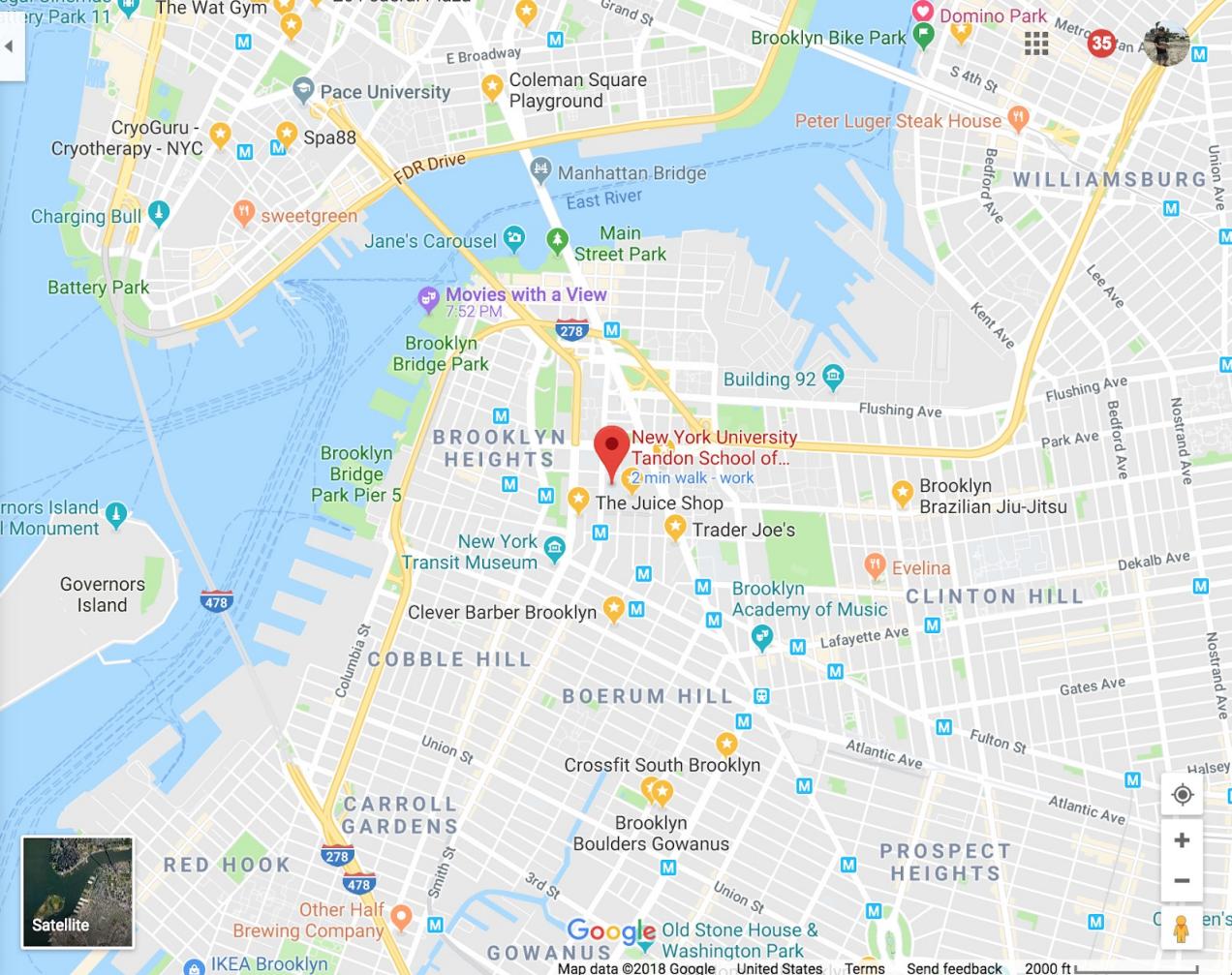
# Semantic Zooming



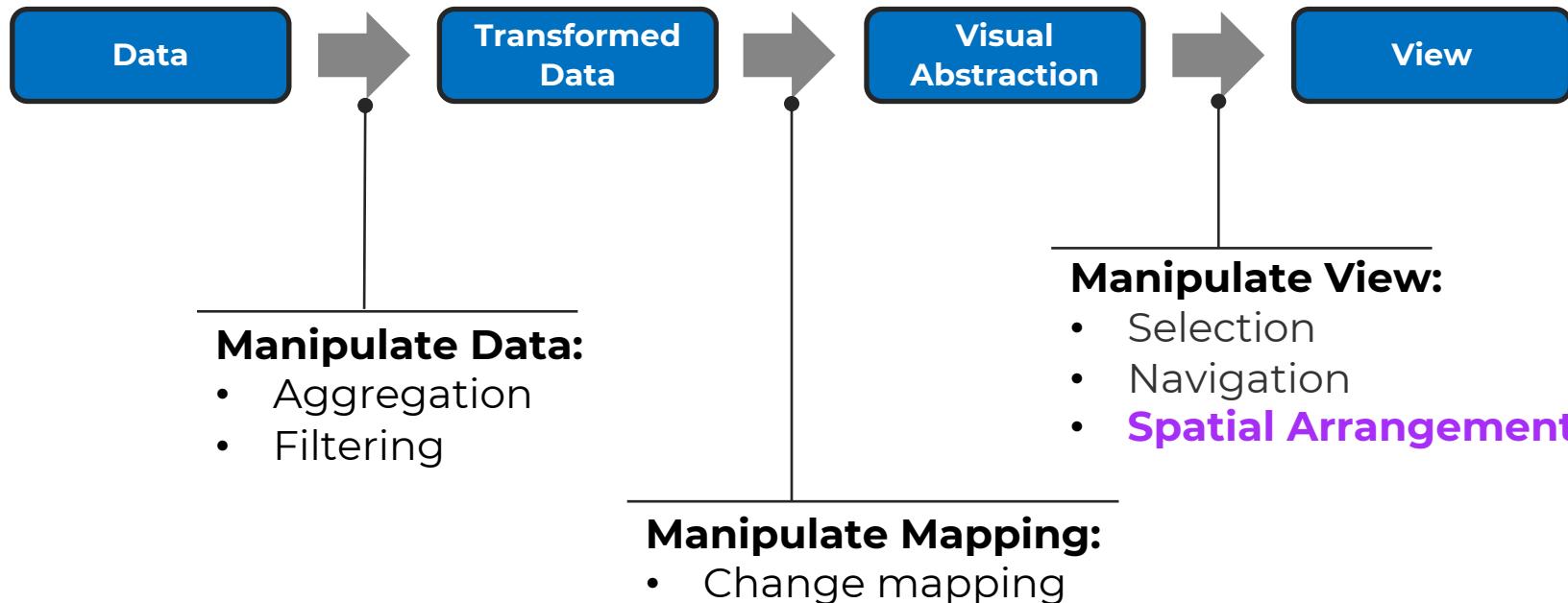
Source: Google Map

PART 01

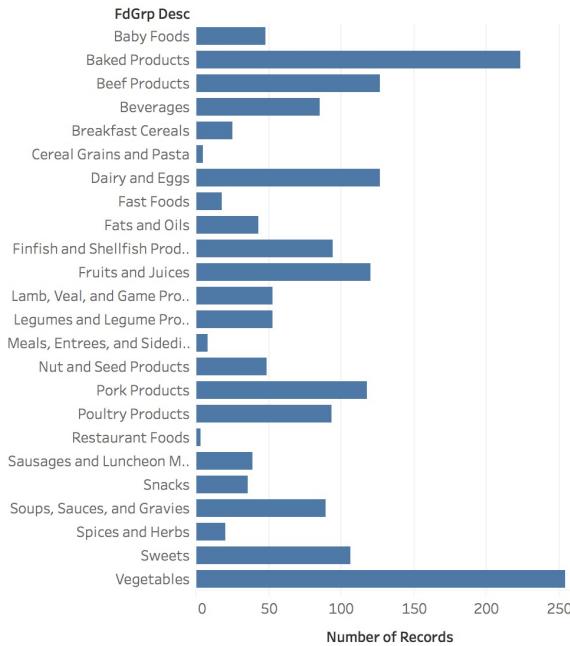
# Semantic Zooming



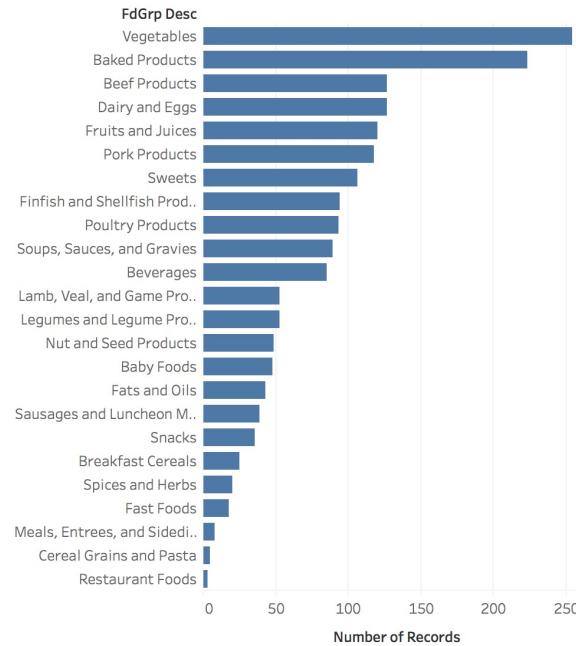
Source: Google Map



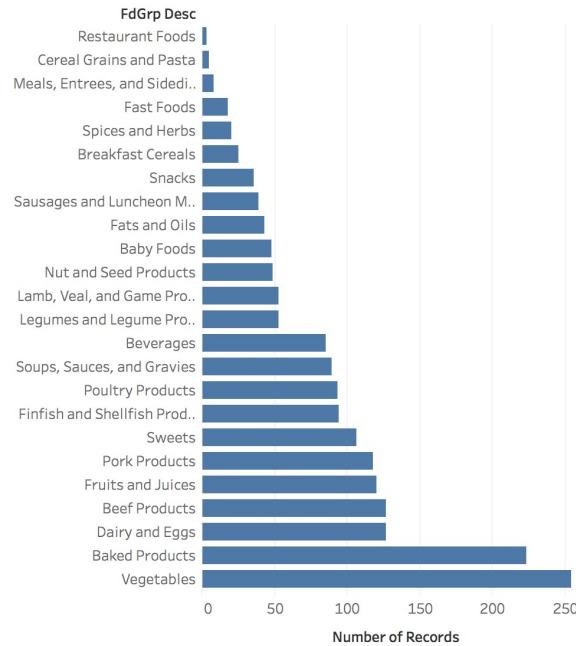
## Alphabetical

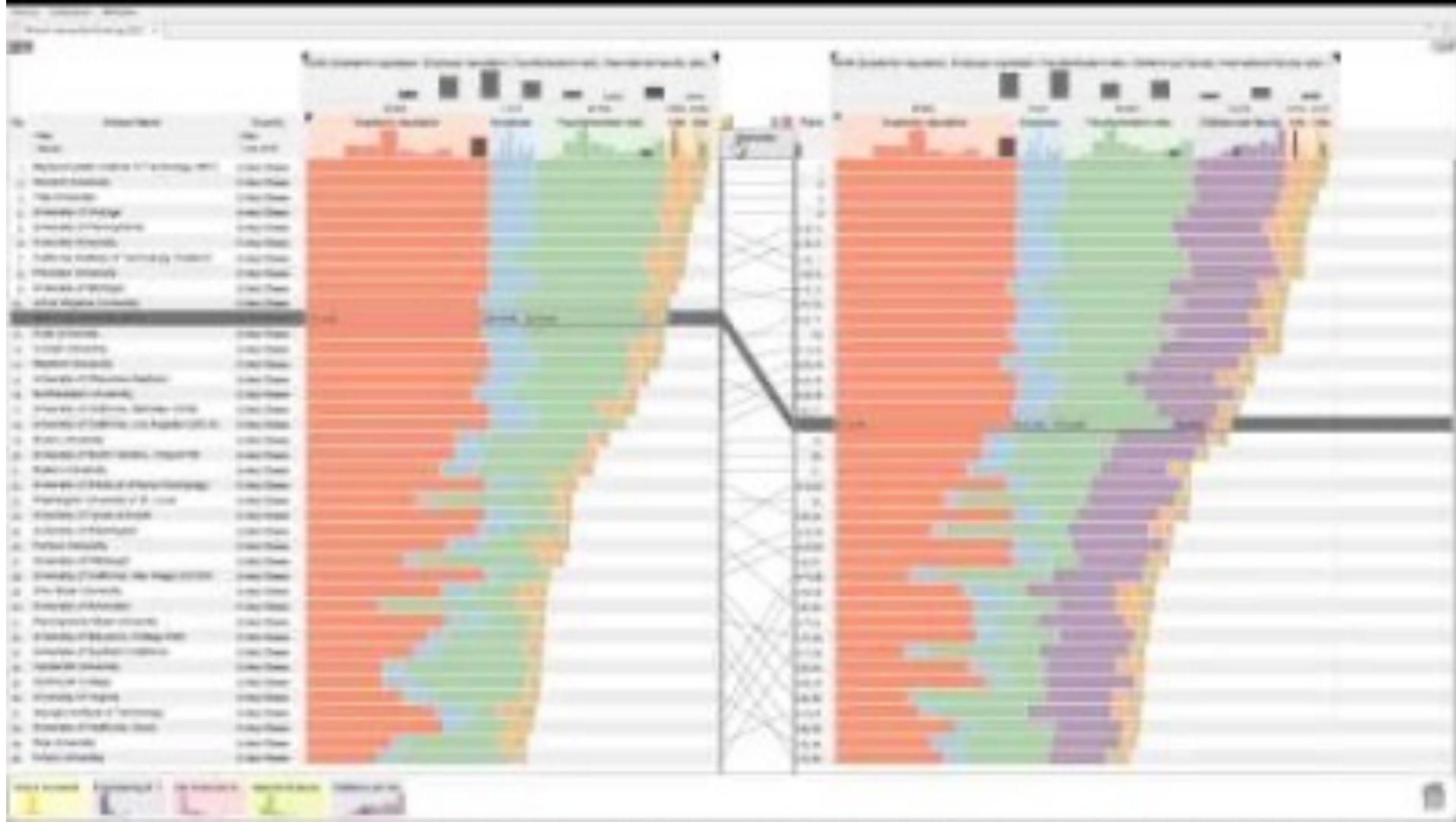


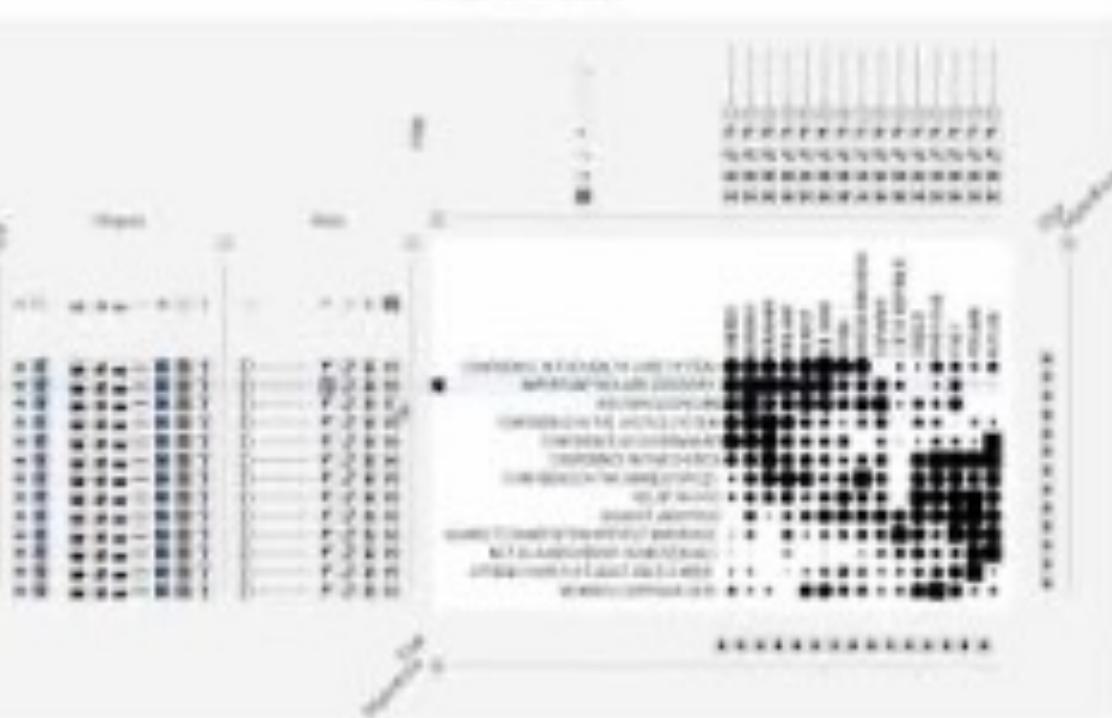
## Descending

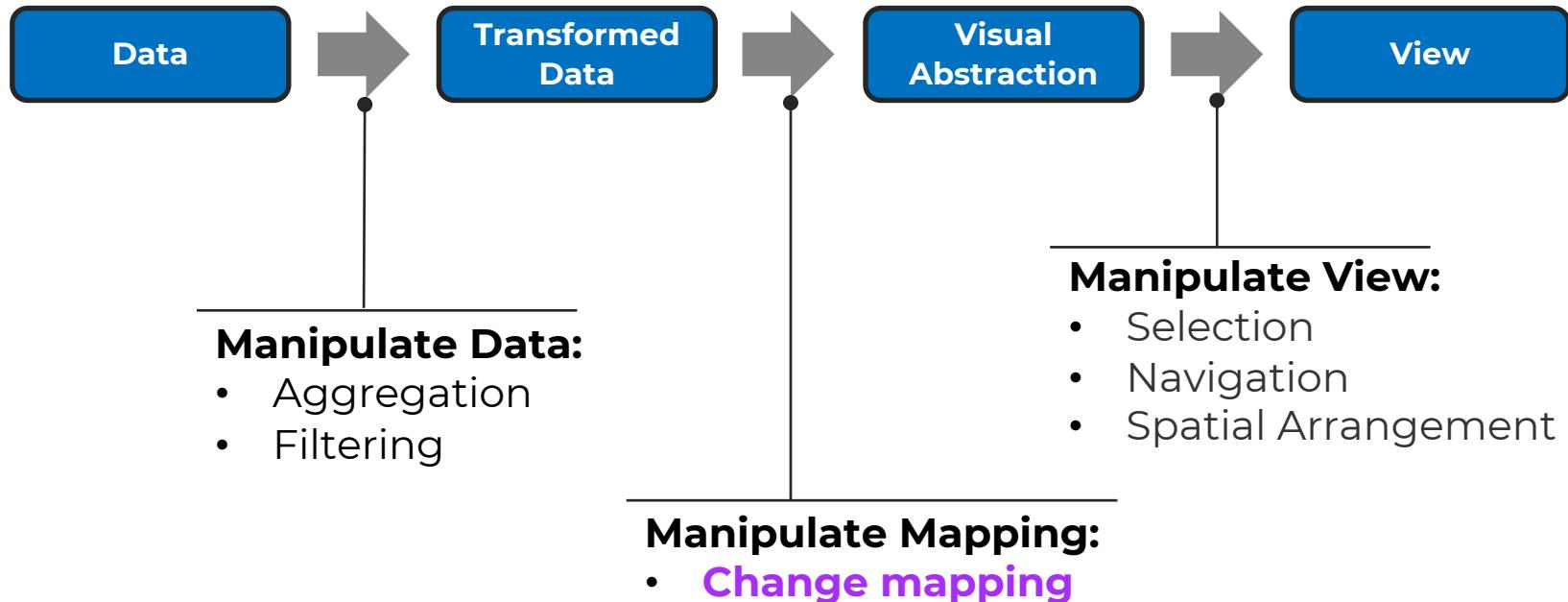


## Ascending









# Change in Mapping

Change the way attributes are encoded in the visual channel.

May lead to use of a completely different graph or change in properties of a given graph.

### Tweets linking to news articles

Algorithm gives tweets  
a more exposure ↑

1.4x

1.3x

1.2x

1.1x

1.0x

0.9x

Algorithm gives tweets  
a less exposure ↓

Average American users per day  
whose feeds linked to site

← More left-leaning

More right-leaning →

0.8x

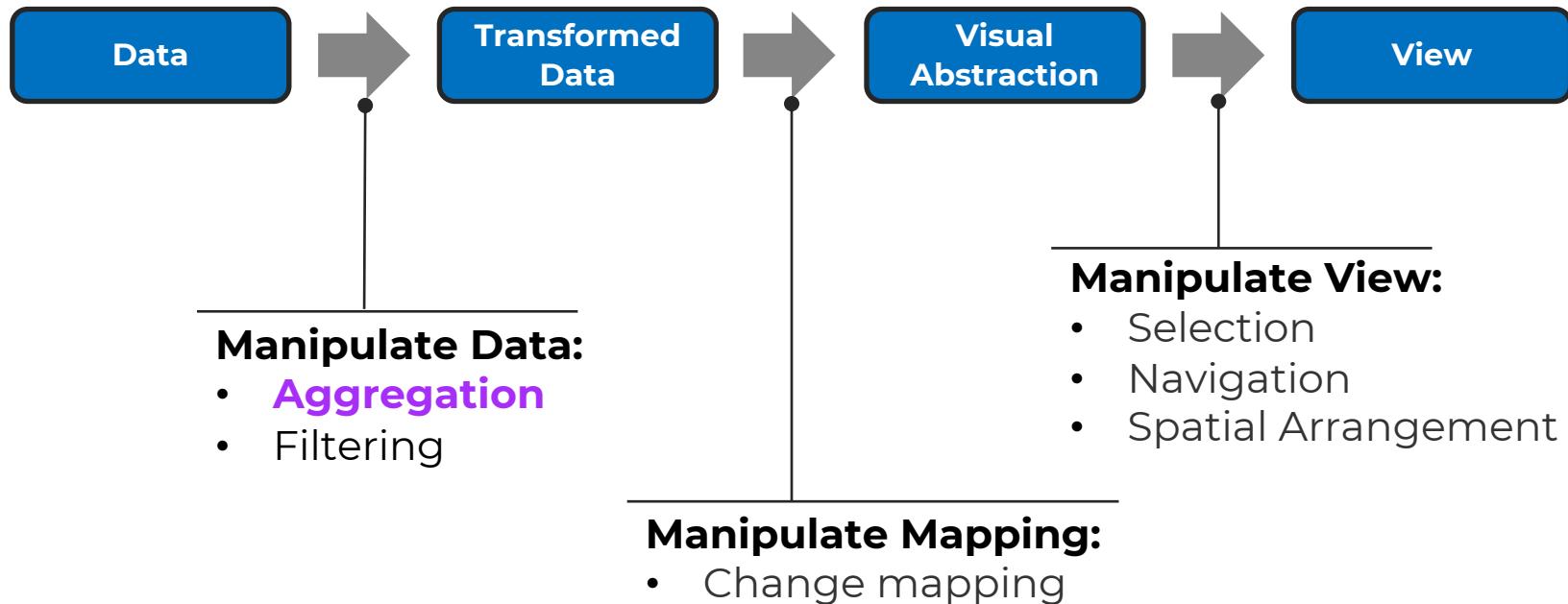
TMZ

The Nation

ProPublica

Trend

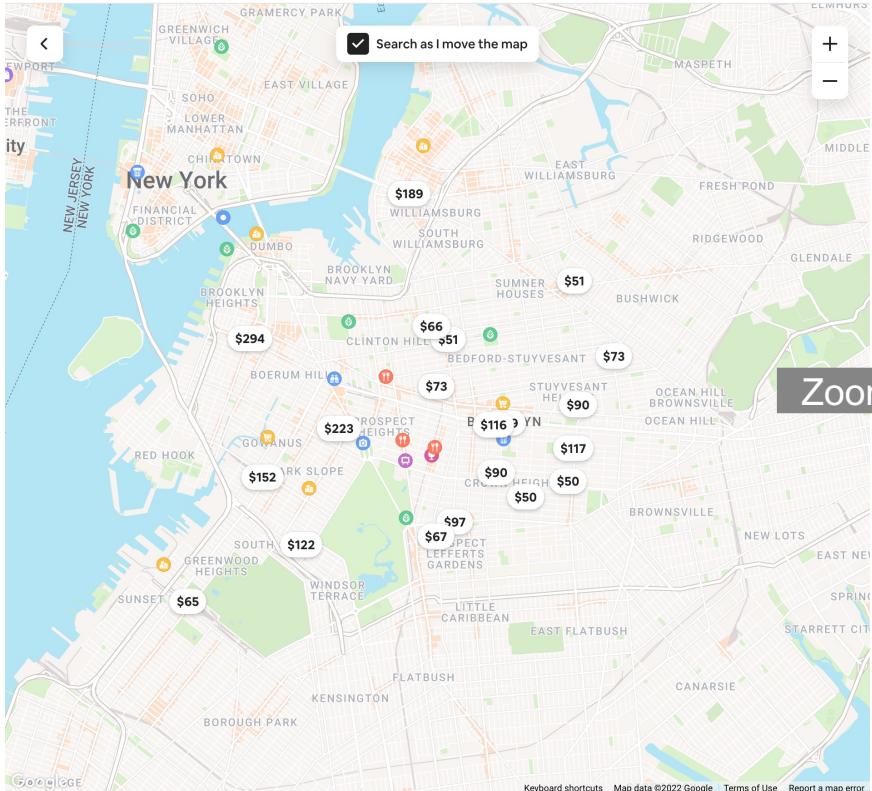
Source: <https://www.economist.com/graphic-detail/2021/11/13/according-to-twitter-tweeters-algorithm-favours-conservatives>



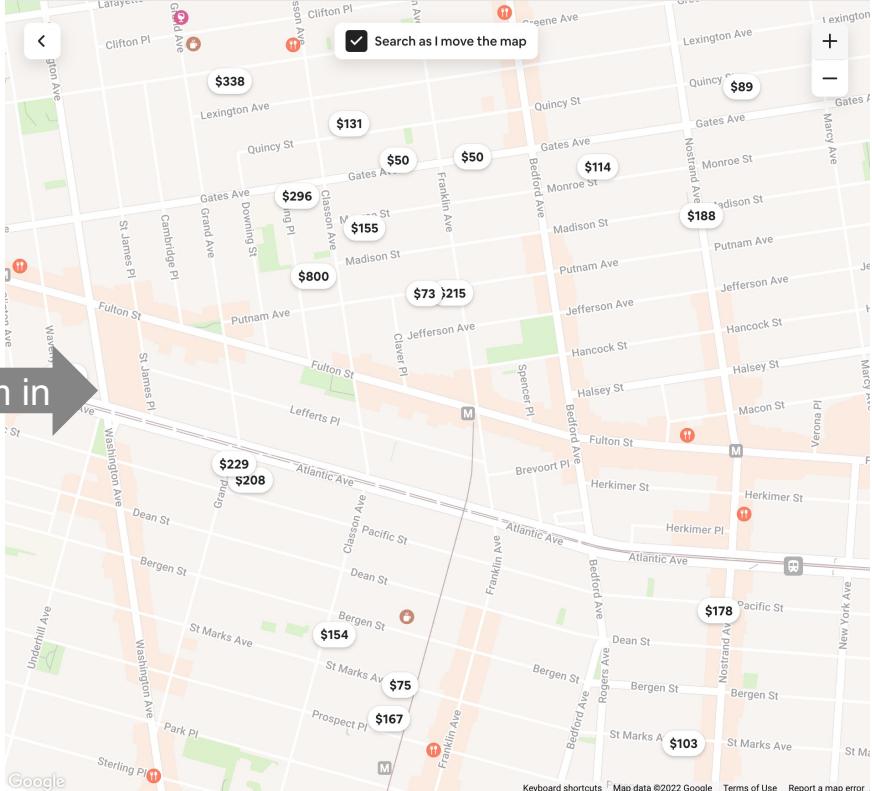
# Aggregation

Change the level of granularity of a given data set  
(related to hierarchical attributes).

Note that **space** and **time** are hierarchical and often require observing patterns at different resolutions.



Zoom in



**4,384.65** ↑2.24% +95.95 Today

Feb 25, 5:04:05 PM UTC-5 · INDEXSP · Disclaimer

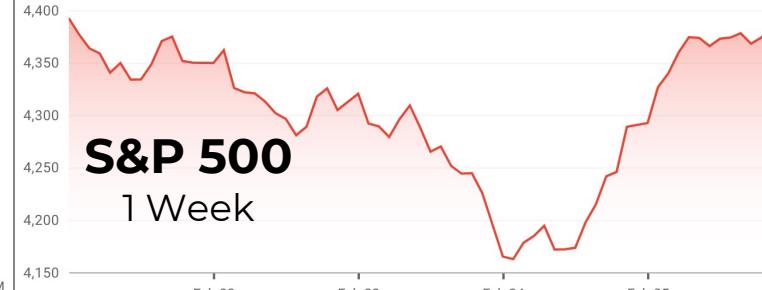
1D 5D 1M 6M YTD 1Y 5Y MAX



**4,384.65** ↓0.18% -7.79 5D

Feb 25, 5:04:05 PM UTC-5 · INDEXSP · Disclaimer

1D 5D 1M 6M YTD 1Y 5Y MAX



**4,384.65** ↑1.34% +58.14 1M

Feb 25, 5:04:05 PM UTC-5 · INDEXSP · Disclaimer

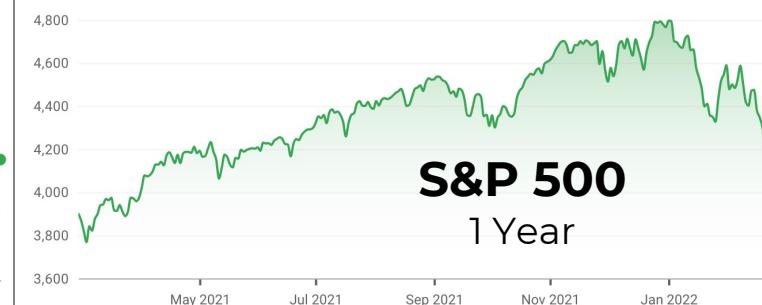
1D 5D 1M 6M YTD 1Y 5Y MAX

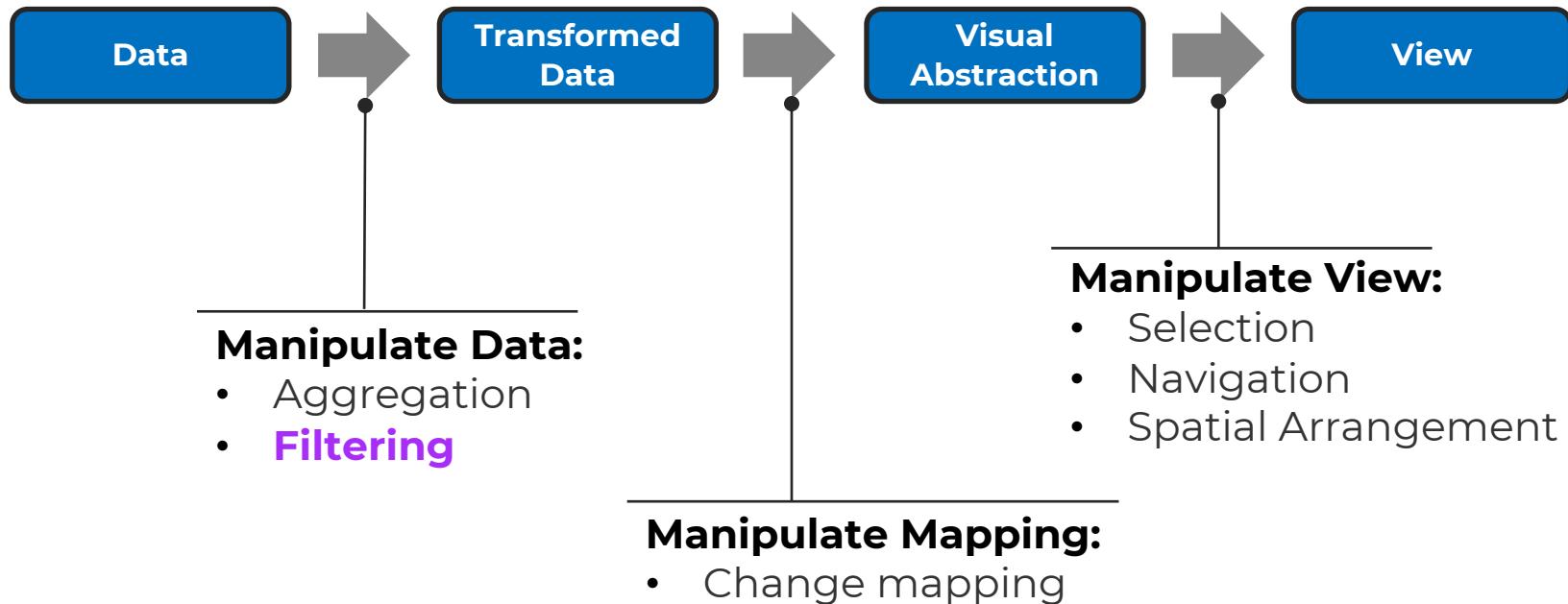


**4,384.65** ↑12.37% +482.83 1Y

Feb 25, 5:04:05 PM UTC-5 · INDEXSP · Disclaimer

1D 5D 1M 6M YTD 1Y 5Y MAX

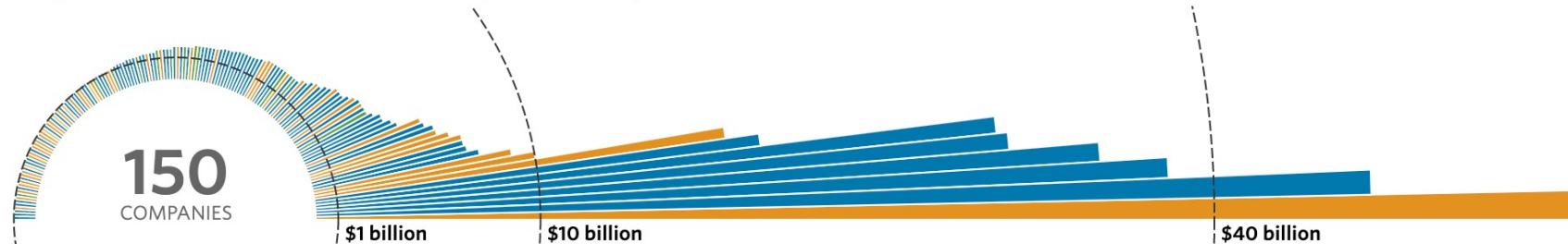




# The Billion Dollar Startup Club

THE WALL STREET JOURNAL.

Companies valued at \$1 billion or more by venture-capital firms



Valuations as of September 2019

Select companies from the chart or table for more detail.

PLAY ►



VIEW BY REGION:



SEARCH TABLE:

VIEW BY INDUSTRY:

 All industries 

CLEAR

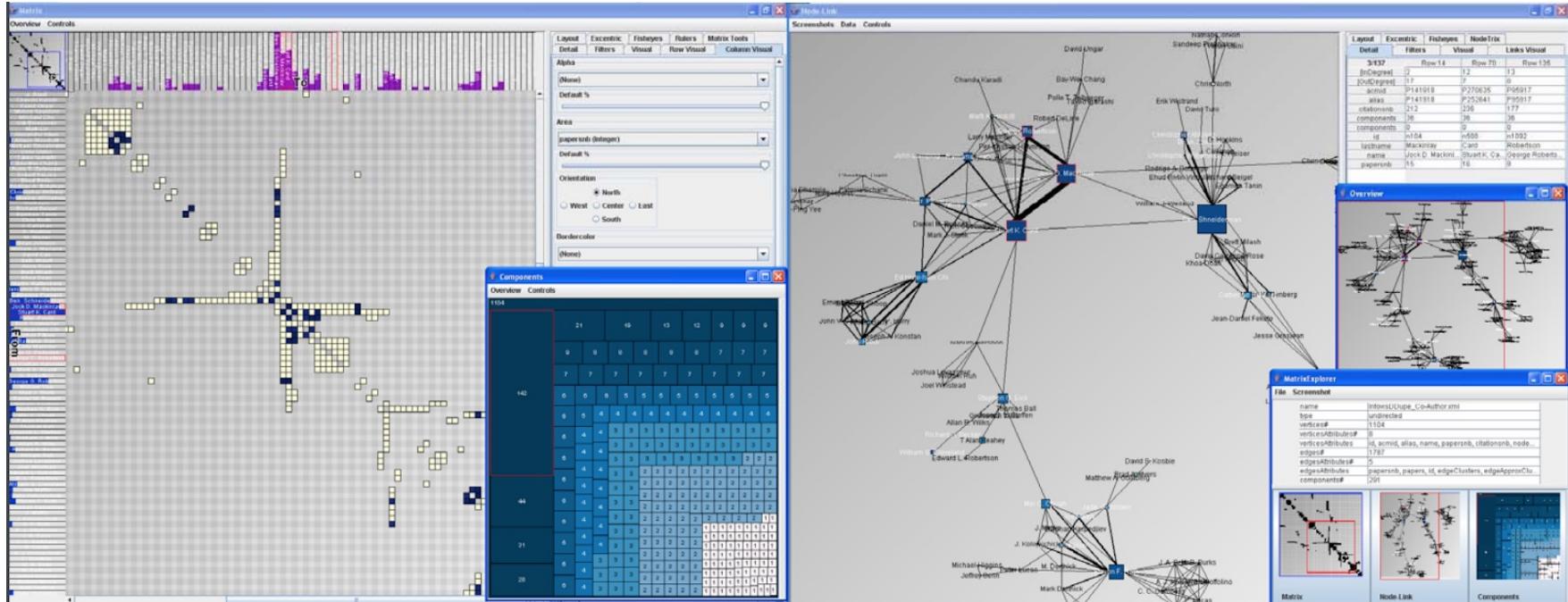
# Multi View Methods

# Why Multi View?

- Show different properties of the same data simultaneously.
    - Different information.
    - Different representation.
  - Use one view to navigate, select, filter information in the other view.
- 
- Subset
  - Attributes
  - Granularity
  - Transformation.

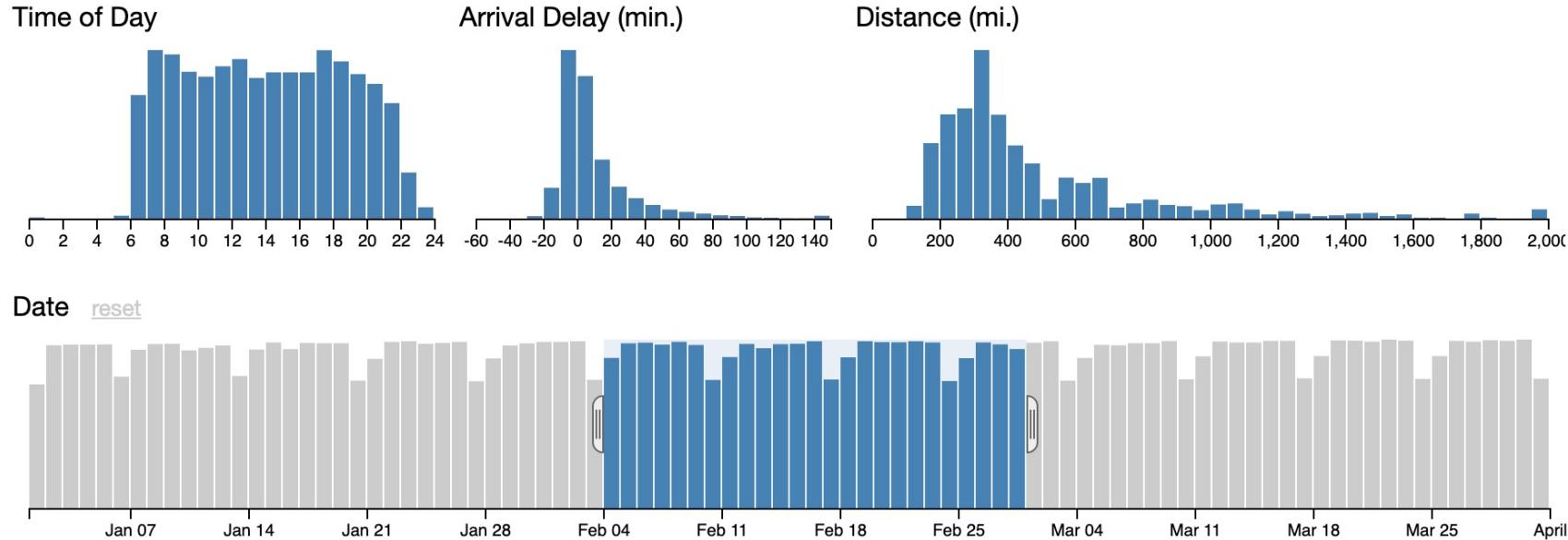
# Matrix Explorer

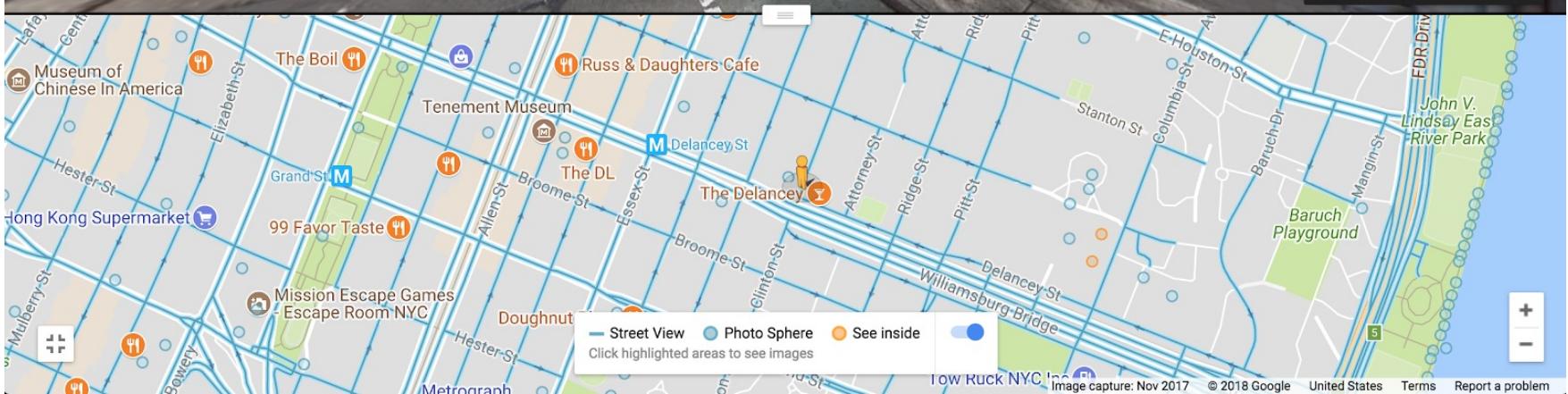
Nathalie Henry Riche, Jean-Daniel Fekete @ INRIA



# Crossfilter

Fast Multidimensional Filtering for Coordinated Views





# Case Study

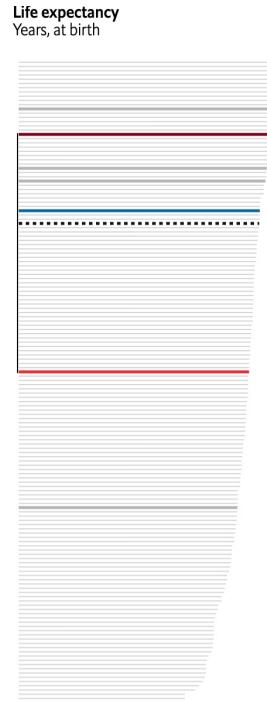
1

## American exceptionalism

United States and its individual races and ethnicities, compared with other countries

Rank out of 146 countries, 2019 or latest available figure

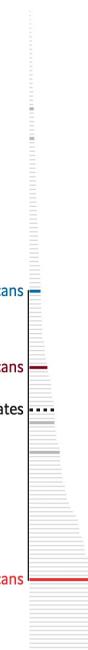
Life expectancy  
Years, at birth



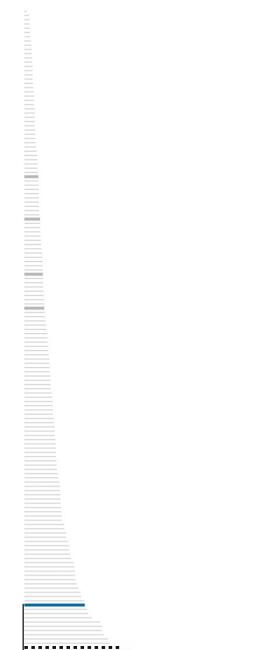
Infant mortality  
Deaths per 1,000 births



Murders  
Per 100,000 people



Prison population  
Per 100,000 people



Sources: Bureau of Justice Statistics; Census Bureau; Centres for Disease Control and Prevention; FBI; International Centre for Prison Studies; World Bank; *The Economist*

\*Excluding the United States

# Case Study

## The Big Mac index

Country	2000 — 2021	Under/over valued, %
Switzerland Franc		20.2
Norway Krone		10.0
United States US\$		BASE CURRENCY
Sweden Krona		-0.4
Uruguay Peso		-6.6
Israel Shekel		-7.9
Canada C\$		-8.4
Venezuela Bolívar		-12.9
Euro area Euro		-14.7
Denmark Krone		-17.0
Britain Pound		-17.1
UAE Dirham		-20.3
New Zealand NZ\$		-20.9
Australia A\$		-22.4
Singapore S\$		-24.9
Brazil Real		-25.8
Argentina Peso		-26.2
Sri Lanka Rupee		-28.6
Kuwait Dinar		-29.0
Costa Rica Colón		-29.0
Czech Rep. Koruna		-29.3

Sources: McDonald's; Refinitiv Datastream; IMF; Eurostat; LebaneseLira.org; Banque du Liban; *The Economist* Note: All prices include tax

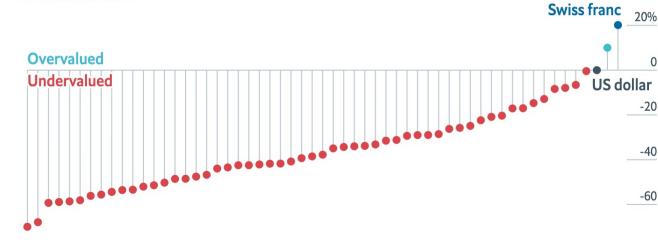
Choose a base currency Show index at  
US dollar Dec 2021

Adjust the index to account for GDP per person

Raw index GDP-adjusted

The Swiss franc is 20.2% overvalued against the US dollar

December 2021



A Big Mac costs SFr6.50 in Switzerland and US\$5.81 in the United States. The implied exchange rate is 1.12. The difference between this and the actual exchange rate, 0.93, suggests the Swiss franc is 20.2% overvalued

2000-2021



US price is an average of four cities: Atlanta, Chicago, New York and San Francisco Get the data

P A R T 0 2

---

# Case Study

# Interactive Data Visualization

