

# Introduction to Data Visualization

Rebecca Bartlett, Heather MacDonald, Scott Turner

# Overview

- Introduction to data visualization theory
- Examples of data visualizations
- Guide to data visualization

# Data Visualization Theory

# What is Data Visualization?

Data (or information) visualization is used to interpret and gain insight into large amounts of data. This is achieved through visual *representations*, often interactive, of raw data.

# Data Visualization:

- Enhances learning
- Enhances understanding
- Enhances reasoning
- Helps in decision making

*Data visualization acts as a link between the raw data and our engagement with it.*

# Data Visualization...

## **Can lead a user to**

- Detect patterns
- Detect trends
- Detect correlations in data

## **Can then prompt a user to**

- Draw inferences
- Anticipate potential trajectories and outcomes
- Ask new questions of the data that wouldn't have otherwise been considered

...some visualizations allow the user to filter out undesirable properties in the dataset. This produces a refined list of results to better help with decision making or understanding (think facets on a database).

So let's apply these ideas to an example:

- [The Middle East: Key Players & Notable Relationships](#)

# The Data Visualization Catalogue

- Provides an excellent introduction to different types of visualizations
- Explore the [Search by Function](#) feature to find the best visualizations for a given purpose



# Thinking about Creating a Data Visualization

- Determine what you are ultimately trying to communicate
- Determine which visualization best achieves your aim in the clearest manner possible

# Further Considerations

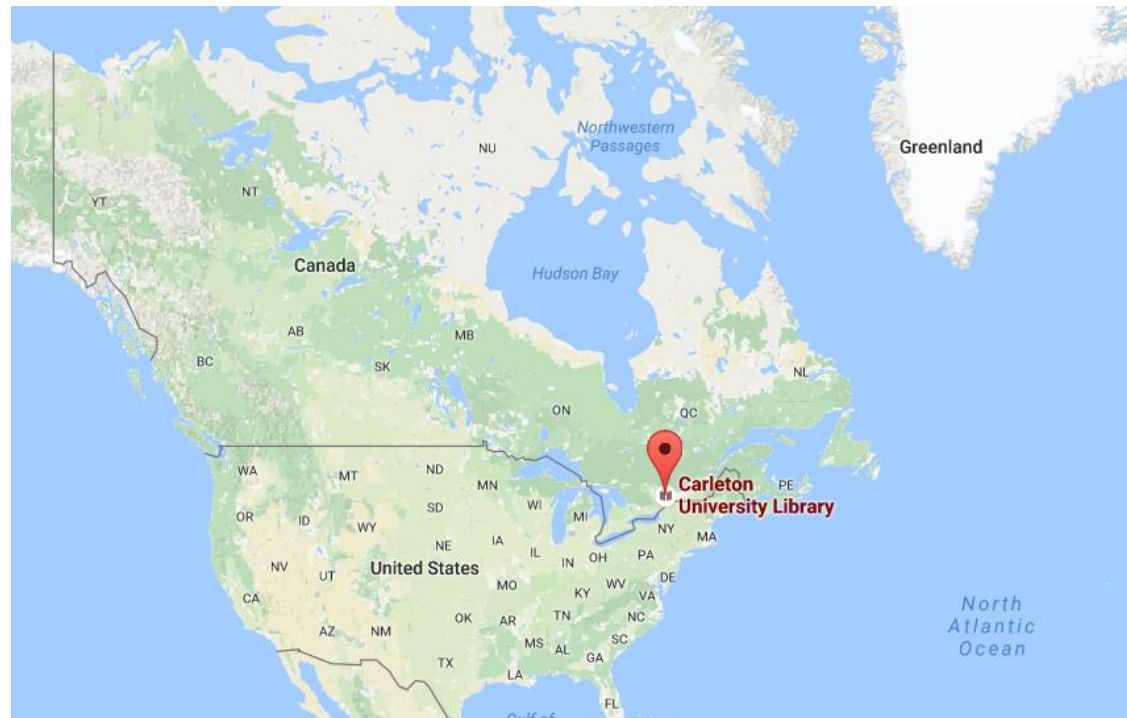
- What data (or subset of data) is **relevant** for your aim?
- Who is your **audience**?
- How will you **encode** your data?
- How will you **structure** the visualization?
- How will you demonstrate the **relationship** between data?
- Determine the **scale** of your visualization.
- Which elements will the user **interact** with?
- Will a user **intuitively understand** how the visualization works and what it represents?

# A Few More Concepts...

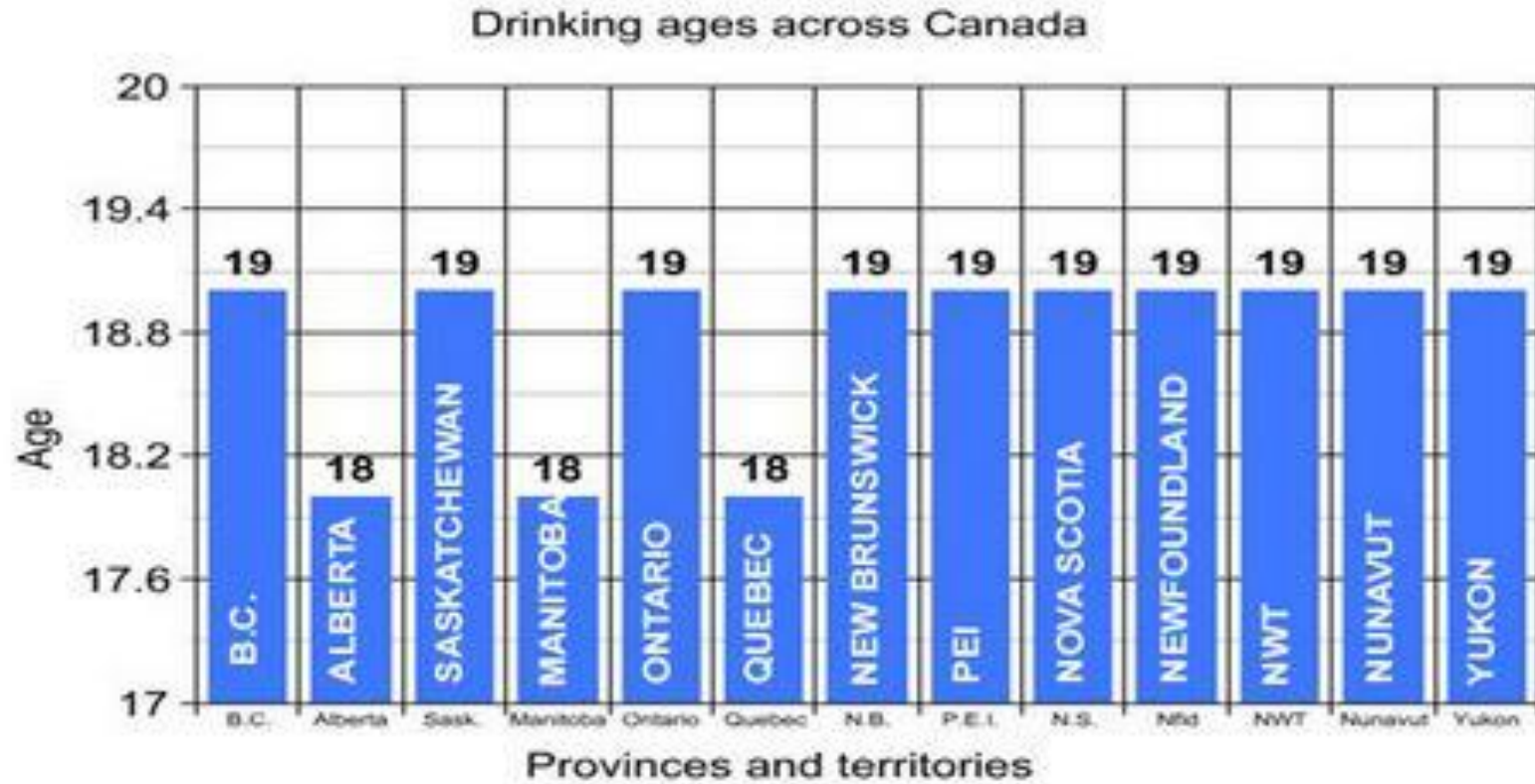
- A visualization is in some sense a **system** of data
- Systems of data are often **hierarchical**
- Within the hierarchy, there may be many **sub-systems/sub-hierarchies**
- A system is made up of **entities**, which potentially have **multiple** properties
- All entities in a system will have some **relationship** to one another

# Putting these Considerations and Concepts into Practice

- Interacting with [Google Maps](#)



# Data Visualization Examples

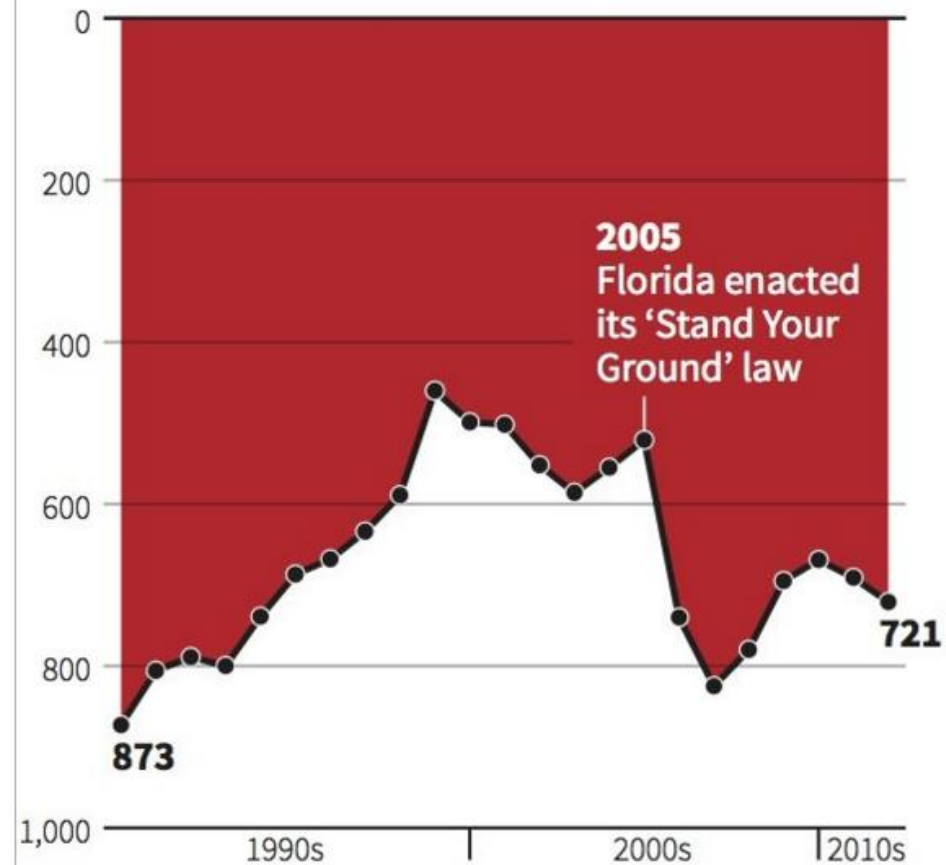


**Canadian Centre on Substance Abuse**

You have to be 19 in Saskatchewan to have a drink, while in Alberta and Manitoba, the drinking age 18. (CBC)

# Gun deaths in Florida

Number of murders committed using firearms



Source: Florida Department of Law Enforcement

C. Chan 16/02/2014

REUTERS

## OPINION

# Obama's Divided Nation

Obama presides over a more divided America than any time in 50 years that was riven by racial lines gathering in 2008 to elect its president. That presidential campaign revealed no evidence that Mr. Obama will close the chasm he has created between his voters and those he attacked and vilified.

It may be true that Mitt Romney failed to respond



Source: AP

problem with polls, especially verbally facile as Mr. Obama that in crunch time, he reverts to No. 1. Exit polls that 9% of the electorate who to vote for just Tuesday; and among 42% said Mr. Obama's Sandy response—the tie photo-op—was a factor. Of those, 70% voted for Mr. Obama. Mr. Christie is a politico who is

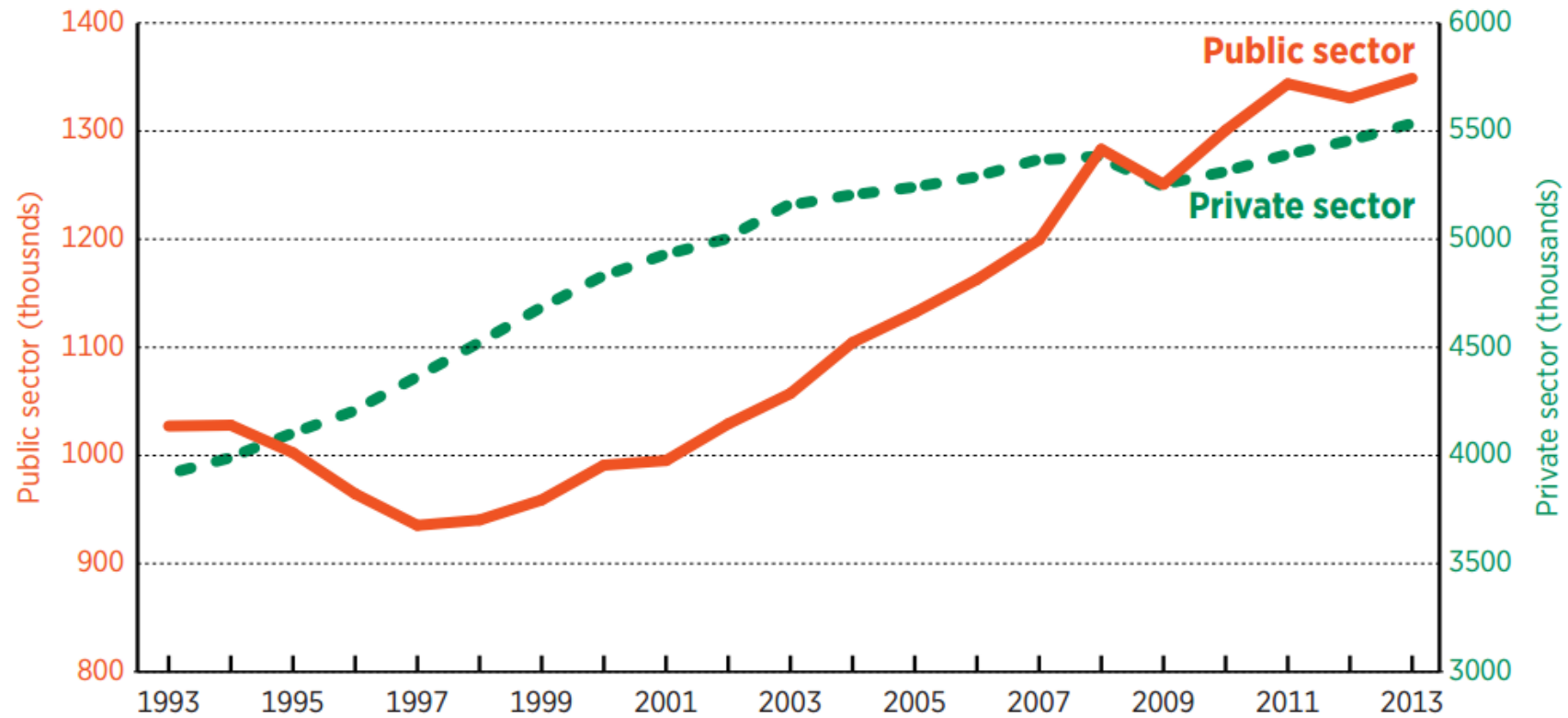
Yes, Republican across two presidential elections that there are no how crudely on issue like illegal immigration. Blowing up the if you thought day's results

drawn attention to what hap-

Obama spoketotum replied: with right and you're wrong. It



**Figure 10: Public- and private-sector jobs (000s) in Ontario, 1993–2013**

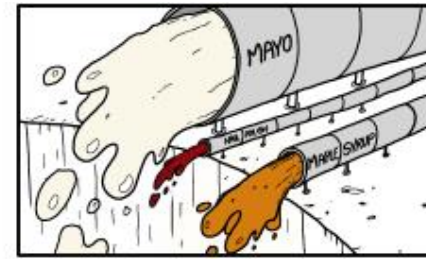


Source: Statistics Canada, CANSIM Table 282-0089: *employment by class of worker and sex, seasonally adjusted and unadjusted; Ontario; Public sector and private sector employees; Both sexes; Seasonally adjusted (x 1,000)*.

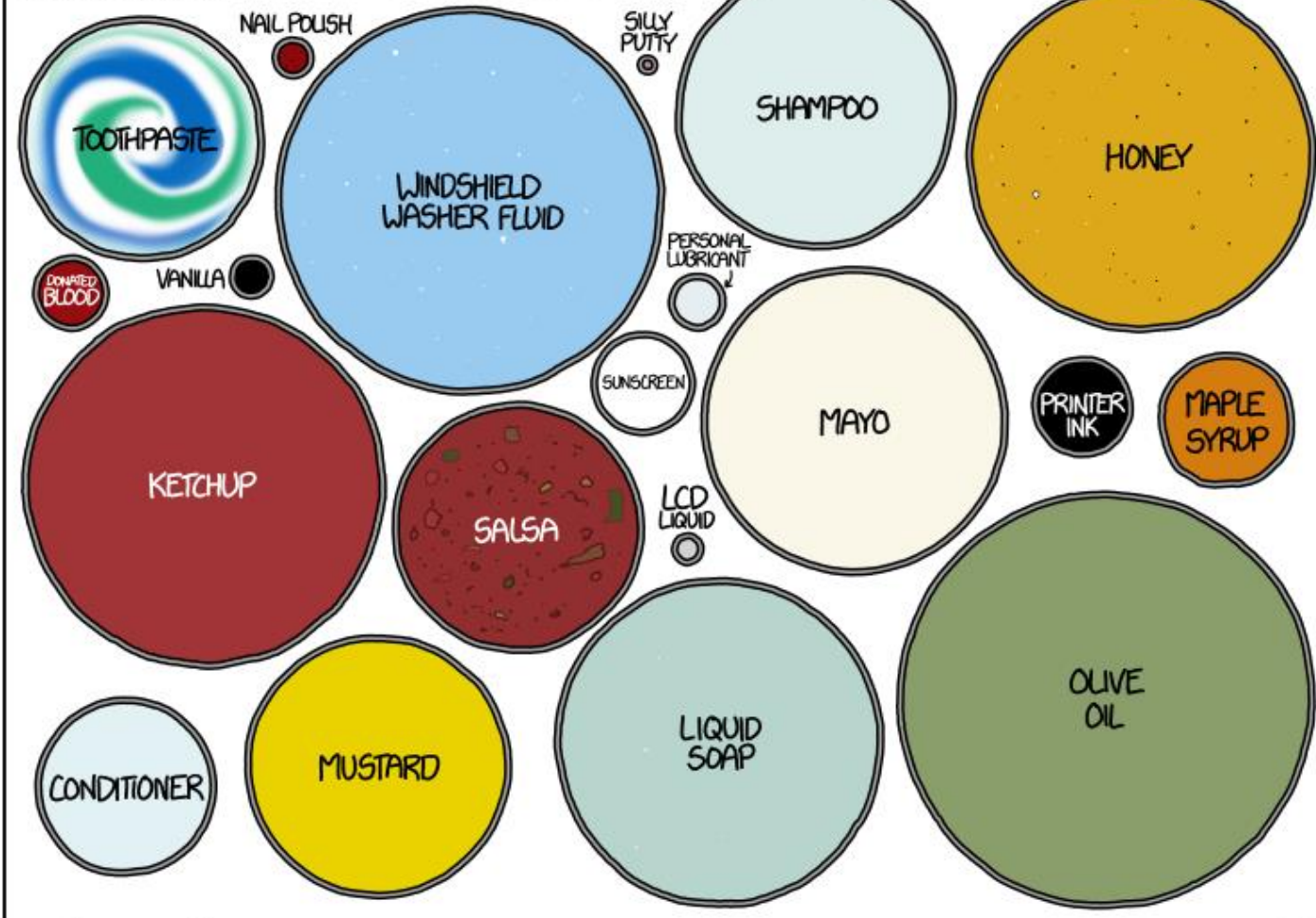
# THE SIZE OF THE US's PIPELINES

IF EACH FLUID PRODUCED OR CONSUMED IN THE US  
HAD TO BE CARRIED BY A SINGLE PIPE

ASSUMING THEY ALL FLOWED AT THE SAME SPEED OF ABOUT 4mph  
NOTE: MANY PIPELINES WOULD OVERLAP (E.G. SODA/CORN SYRUP)

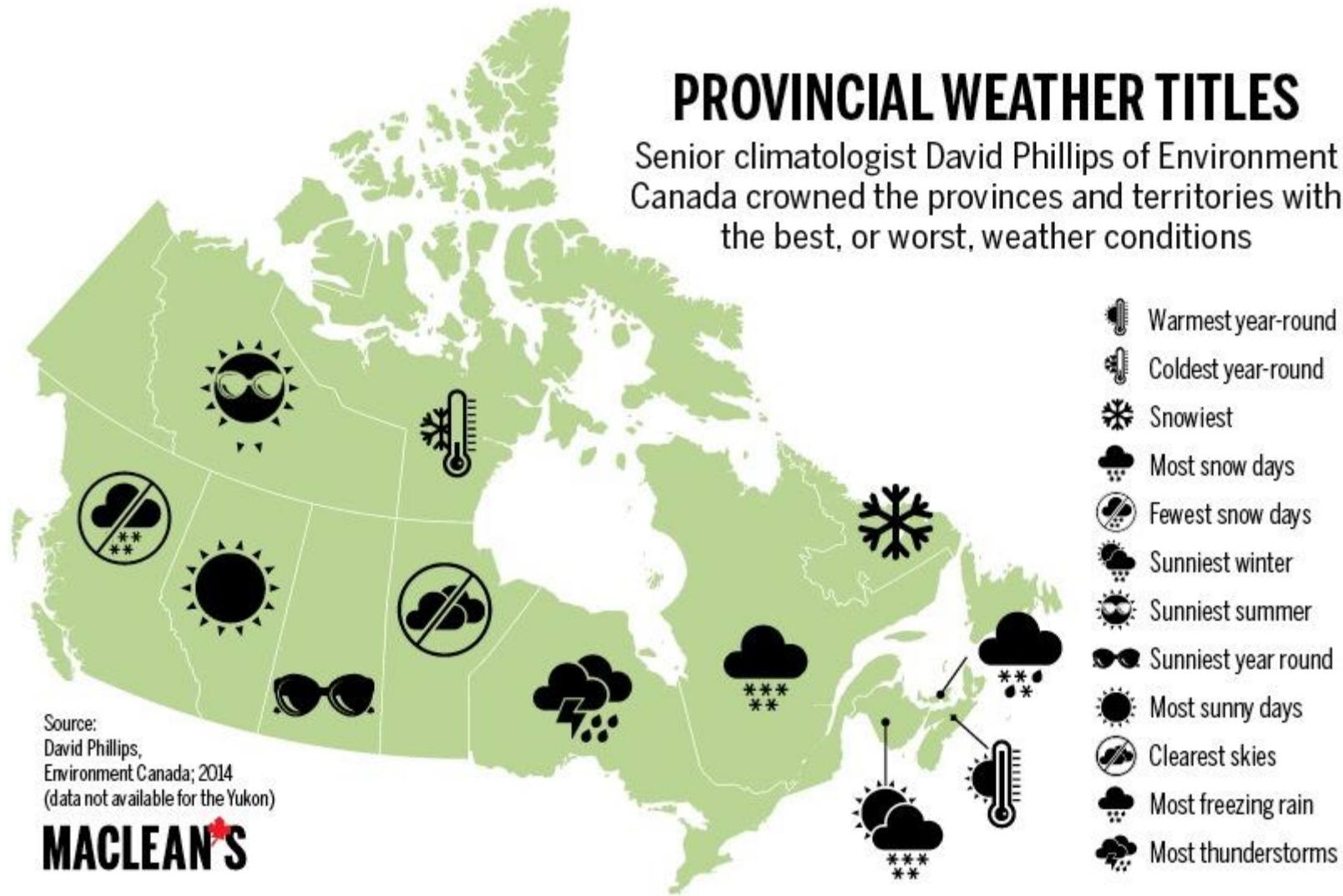


ACTUAL SIZE (WHEN VIEWED ON A TYPICAL COMPUTER SCREEN)



# PROVINCIAL WEATHER TITLES

Senior climatologist David Phillips of Environment Canada crowned the provinces and territories with the best, or worst, weather conditions



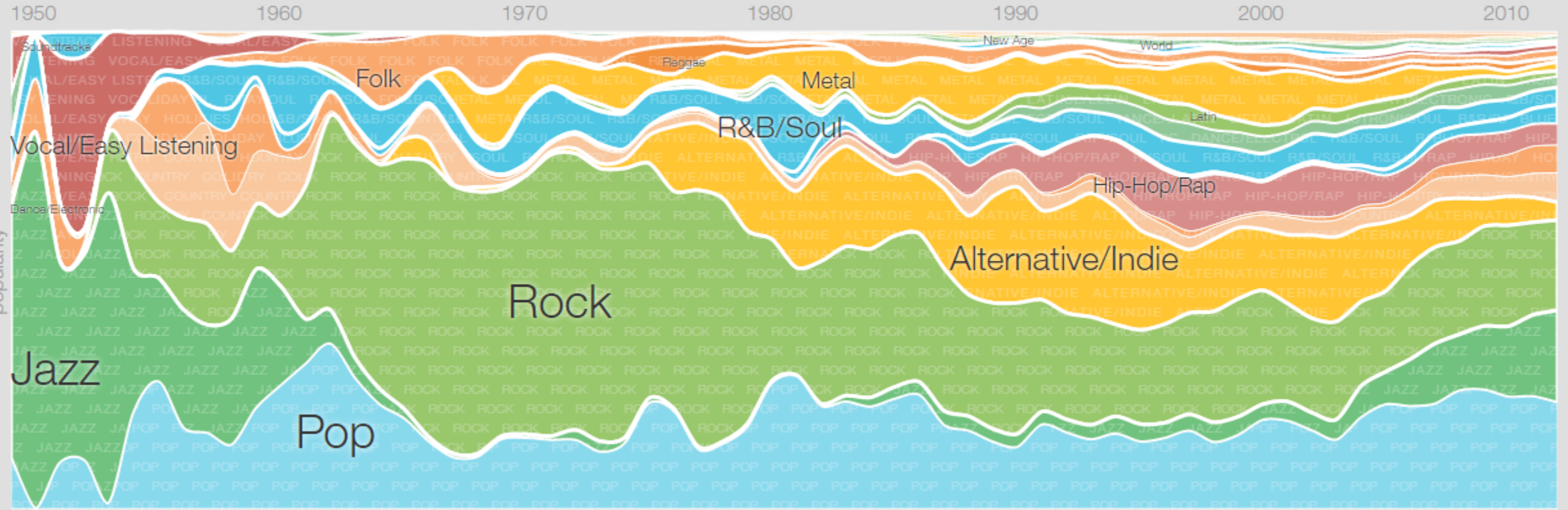
Source:  
David Phillips,  
Environment Canada; 2014  
(data not available for the Yukon)

**MACLEAN'S**

# Music Timeline

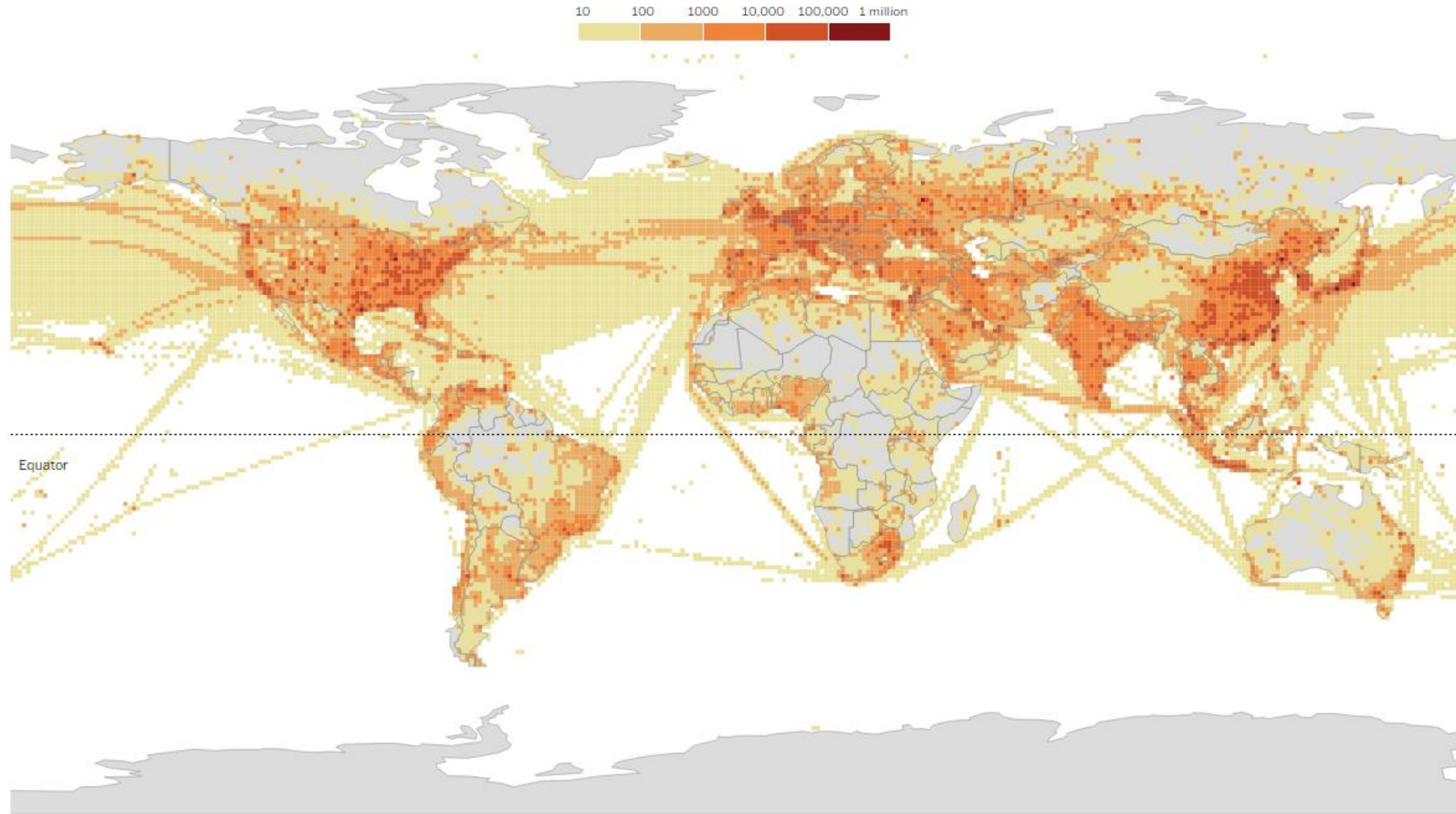
Album or artist:

[FAQ](#)



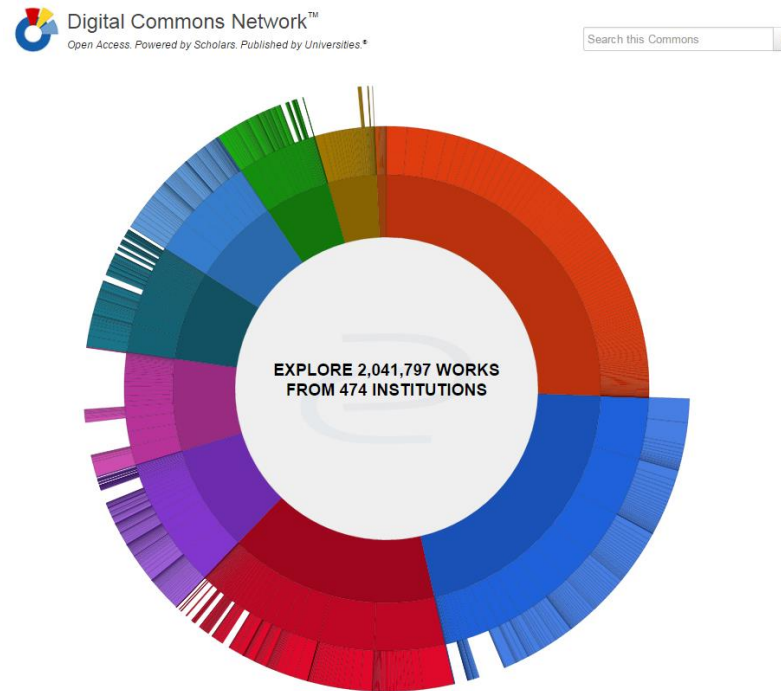


Fossil fuel emissions, 2001-2012 mean, grams of carbon dioxide



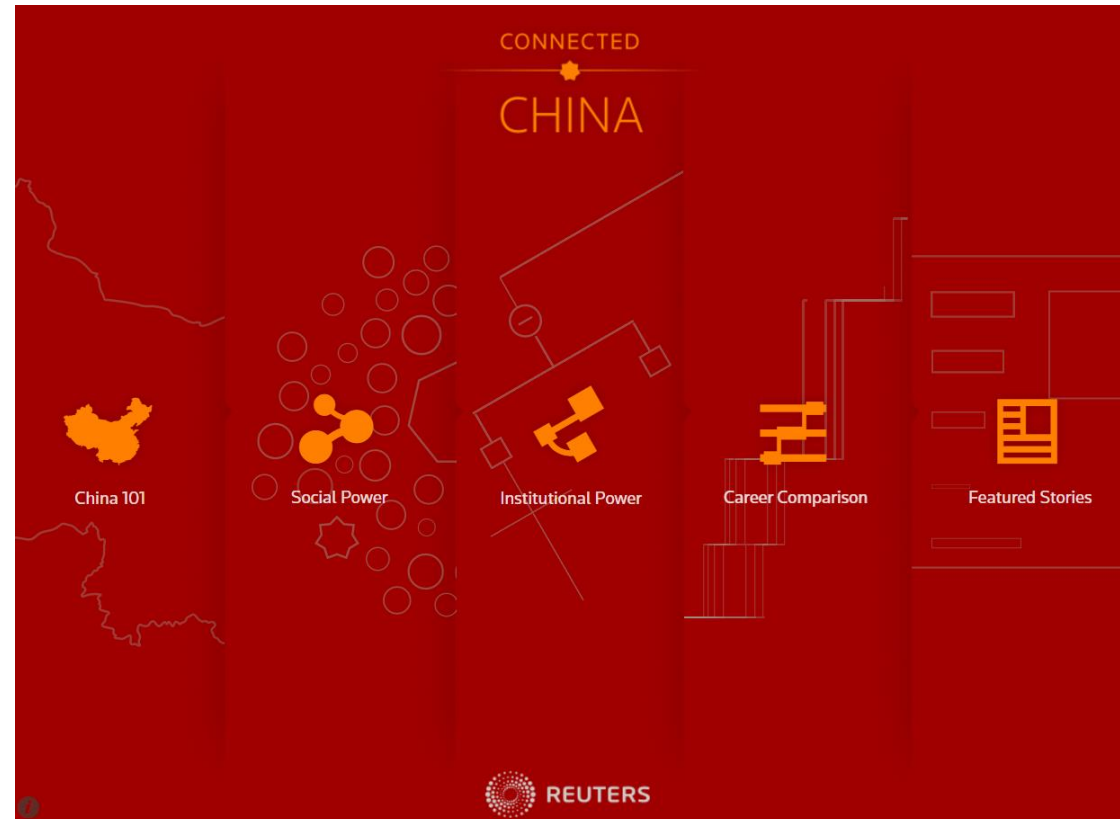
# Powerful Visualization, but not Immediately Intuitive

- [Digital Commons Network](#) – *Open Access. Powered by Scholars. Published by Universities.*



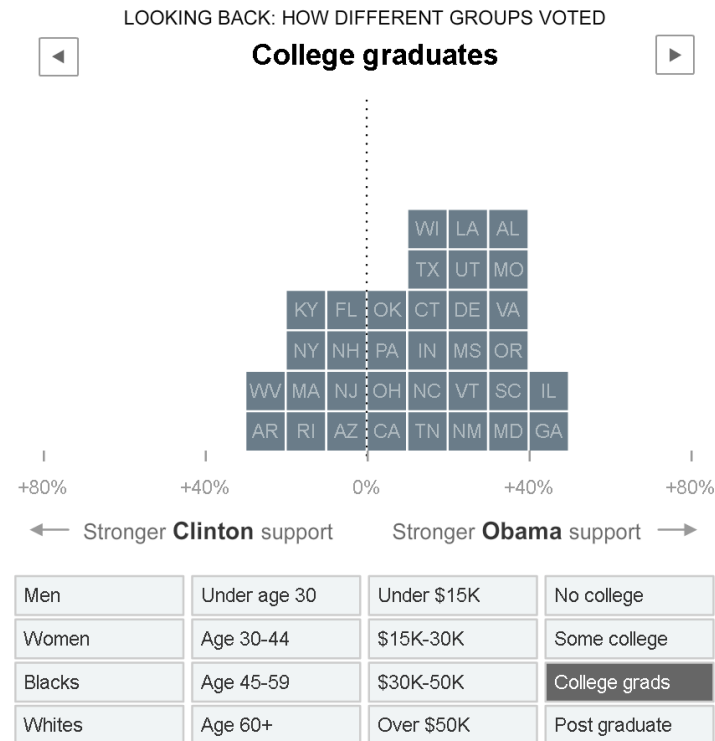
# Using Visualization for Story-Telling

- [Connected China](#) – *Reuters*



# Proximity Relationships in Context

- [Looking Back: How Different Groups Voted](#) (2008 U.S. Presidential election, Democratic nomination)





# Data Visualization Guide

<https://library.carleton.ca/research/subject-guides/data-visualization-detailed-guide>