



CHANGE THE WORLD FROM HERE

# Time Series Visualization

# TIME SERIES DATA

# Time Series

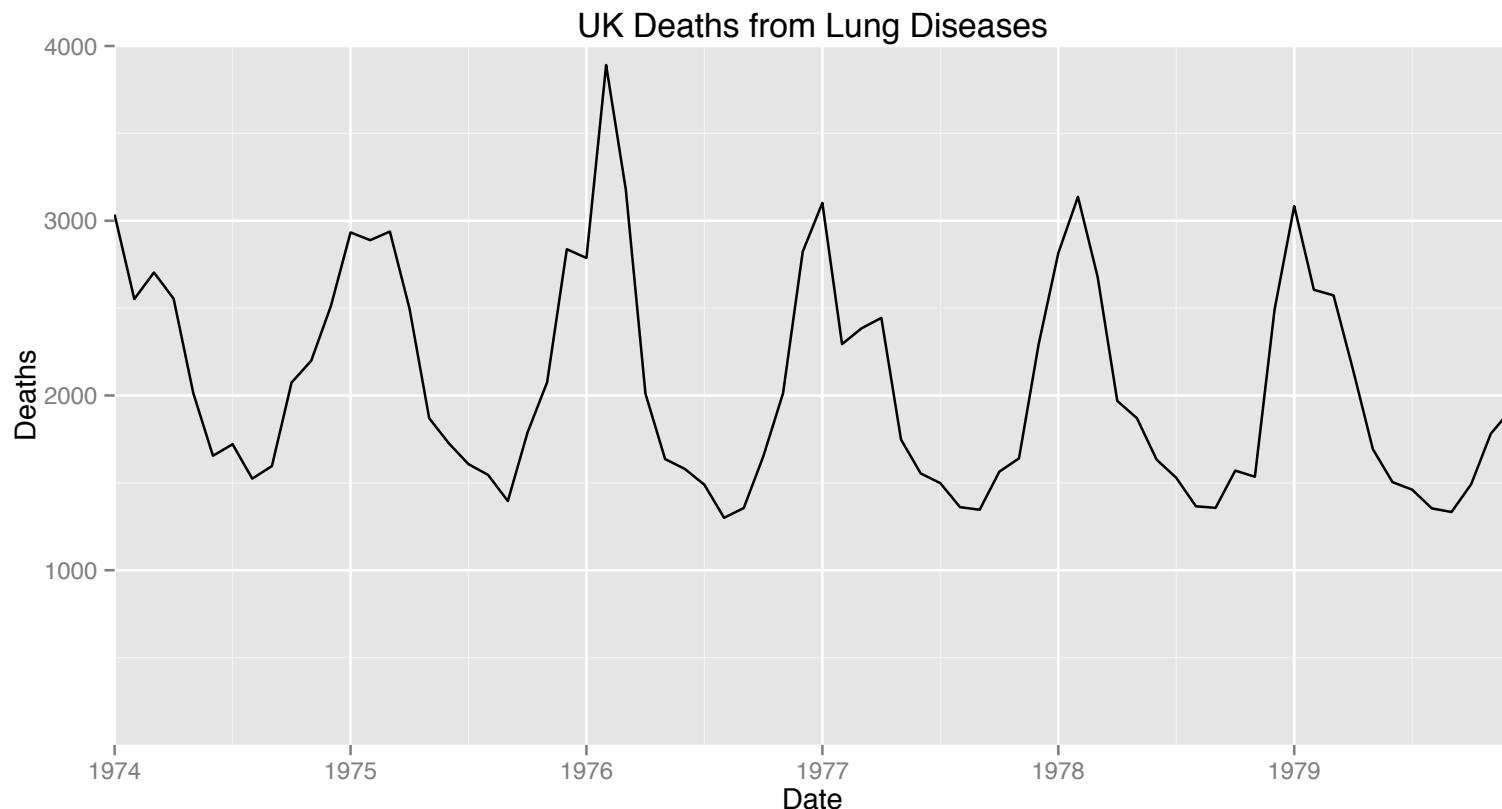
- Series of values that change over time
- Values often spaced at regular time intervals
  - e.g. temperature, stock market, heart beat monitor
- Values may be spaced at irregular time intervals
  - e.g. system logs, version history, earthquakes

# BASIC TECHNIQUES

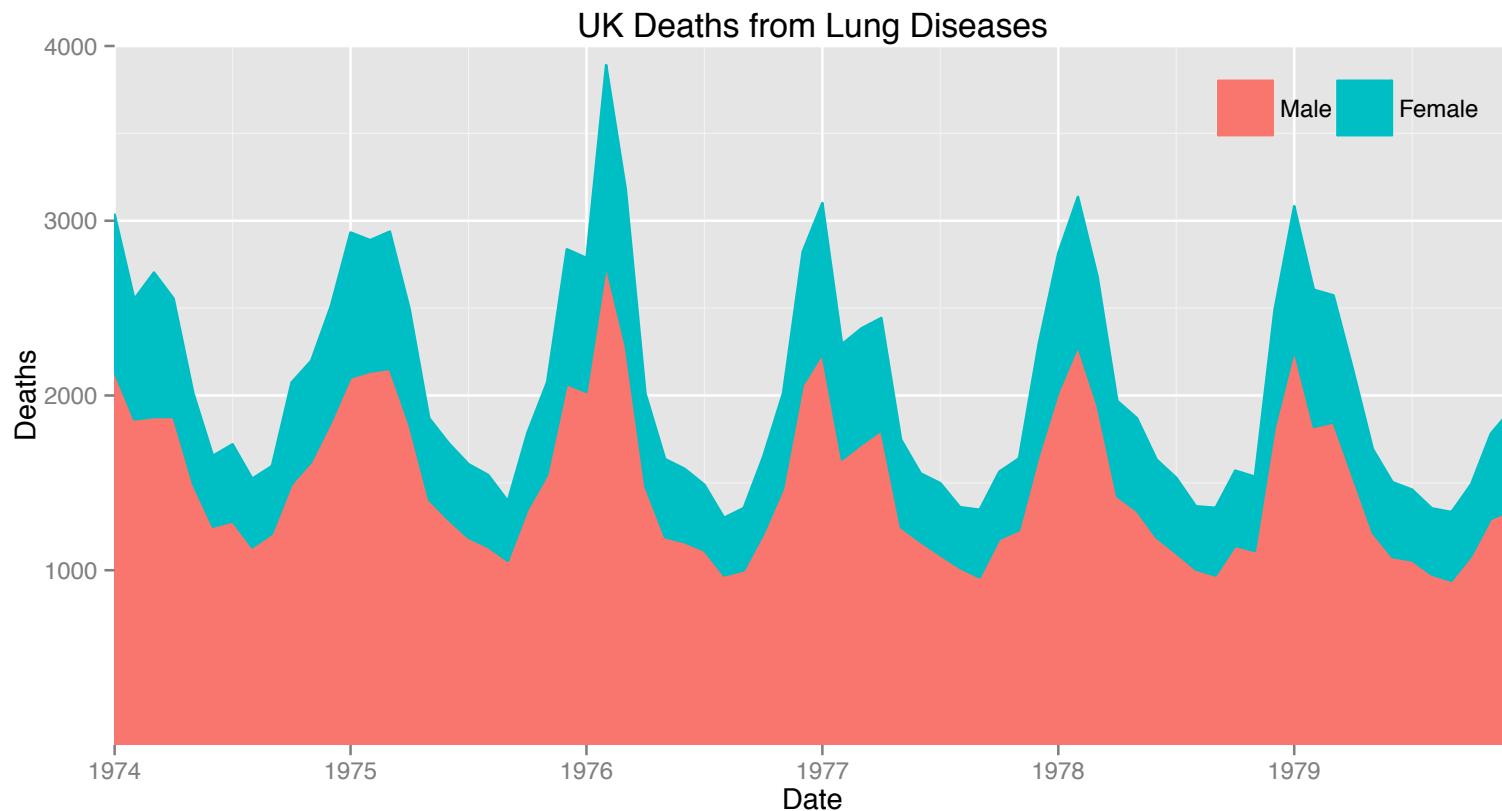
Illustrated in R, ggplot2, and shiny

# Basic Techniques

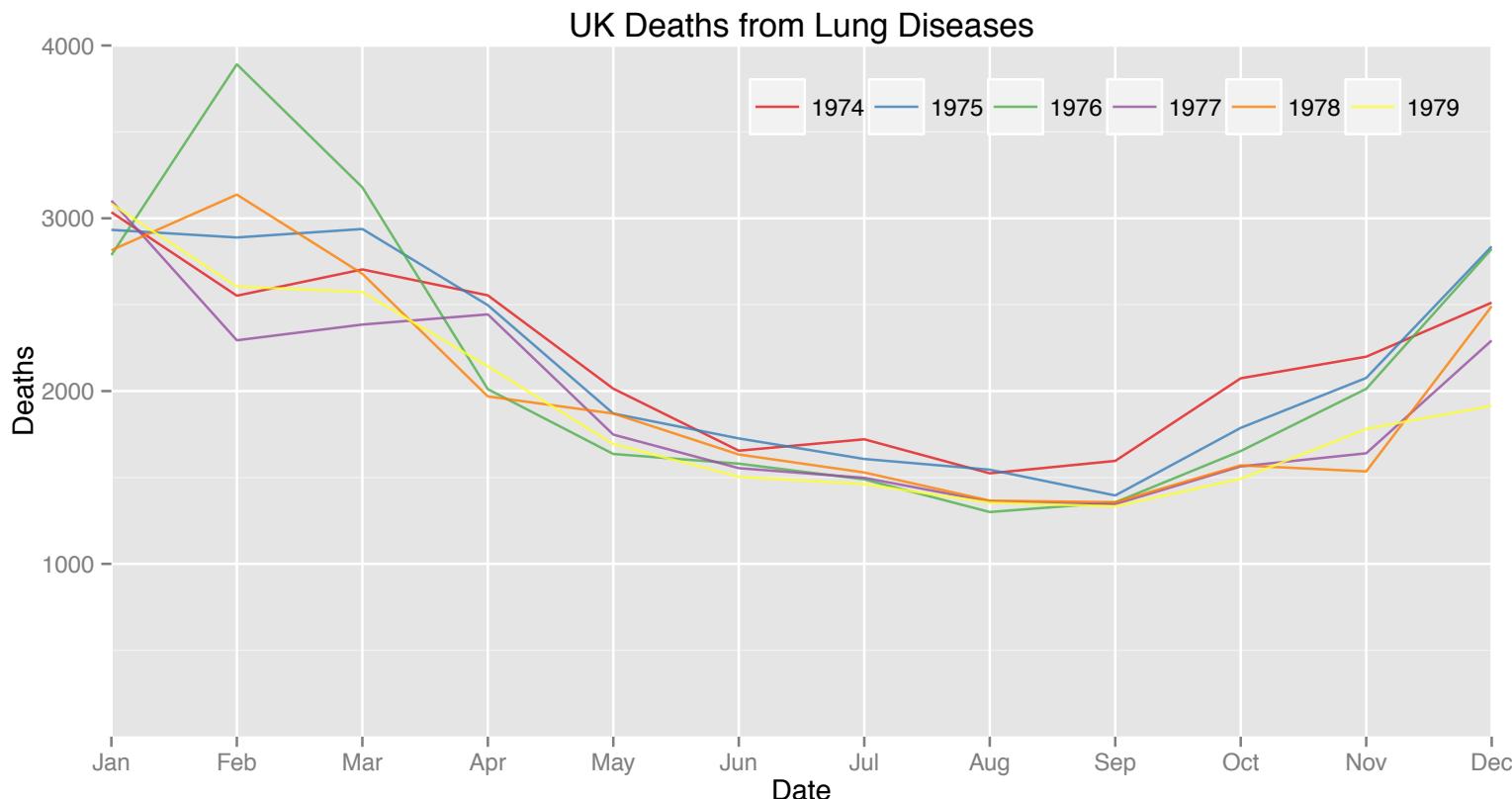
- Plot time on x-axis, value on y-axis
  - e.g. *line, bar, area plots*
- Plot two variables on x-axis and y-axis, show time via motion by animating changes over time
  - e.g. *animated bubble plot, geospatial visualizations, linked views*



Line Plot

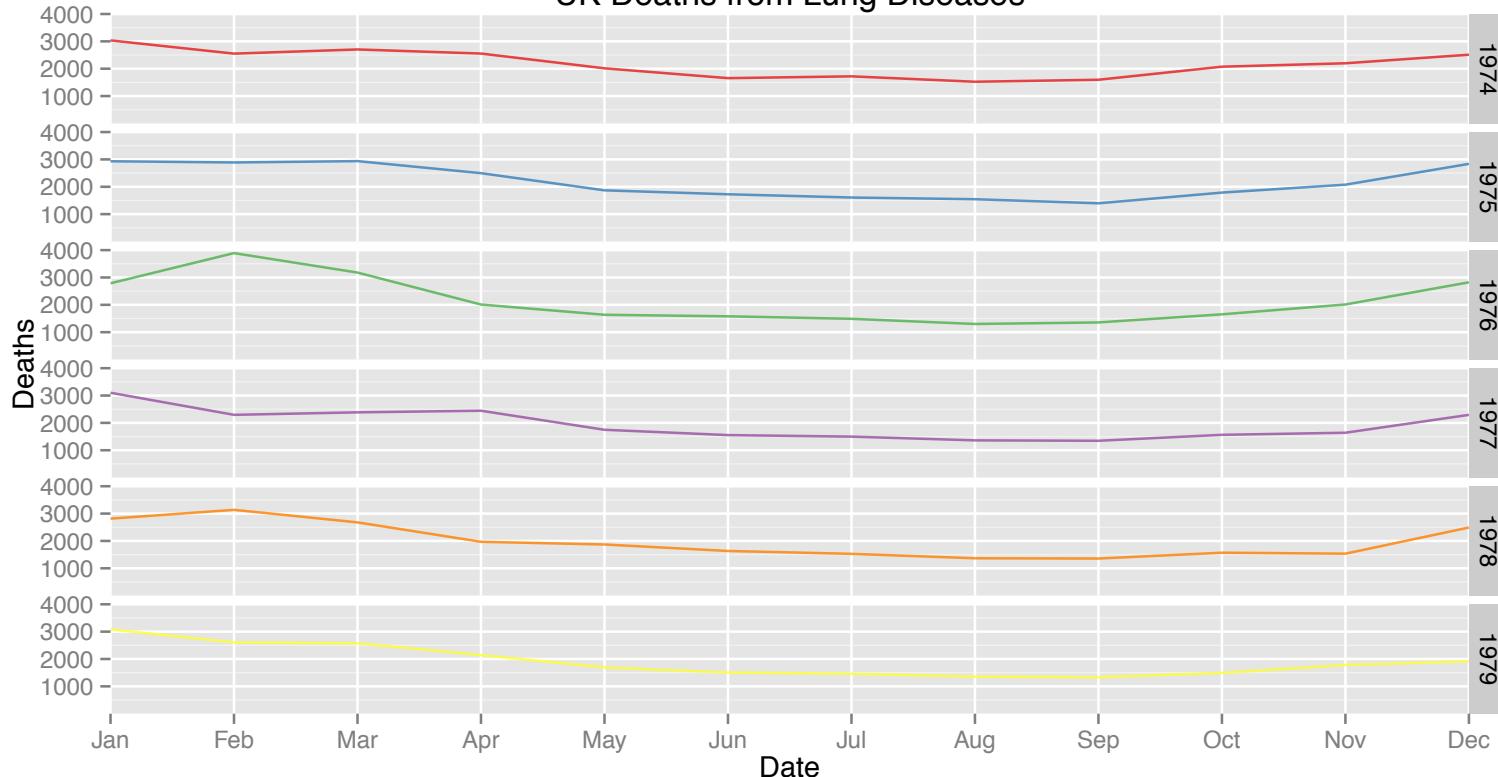


Stacked Area Plot



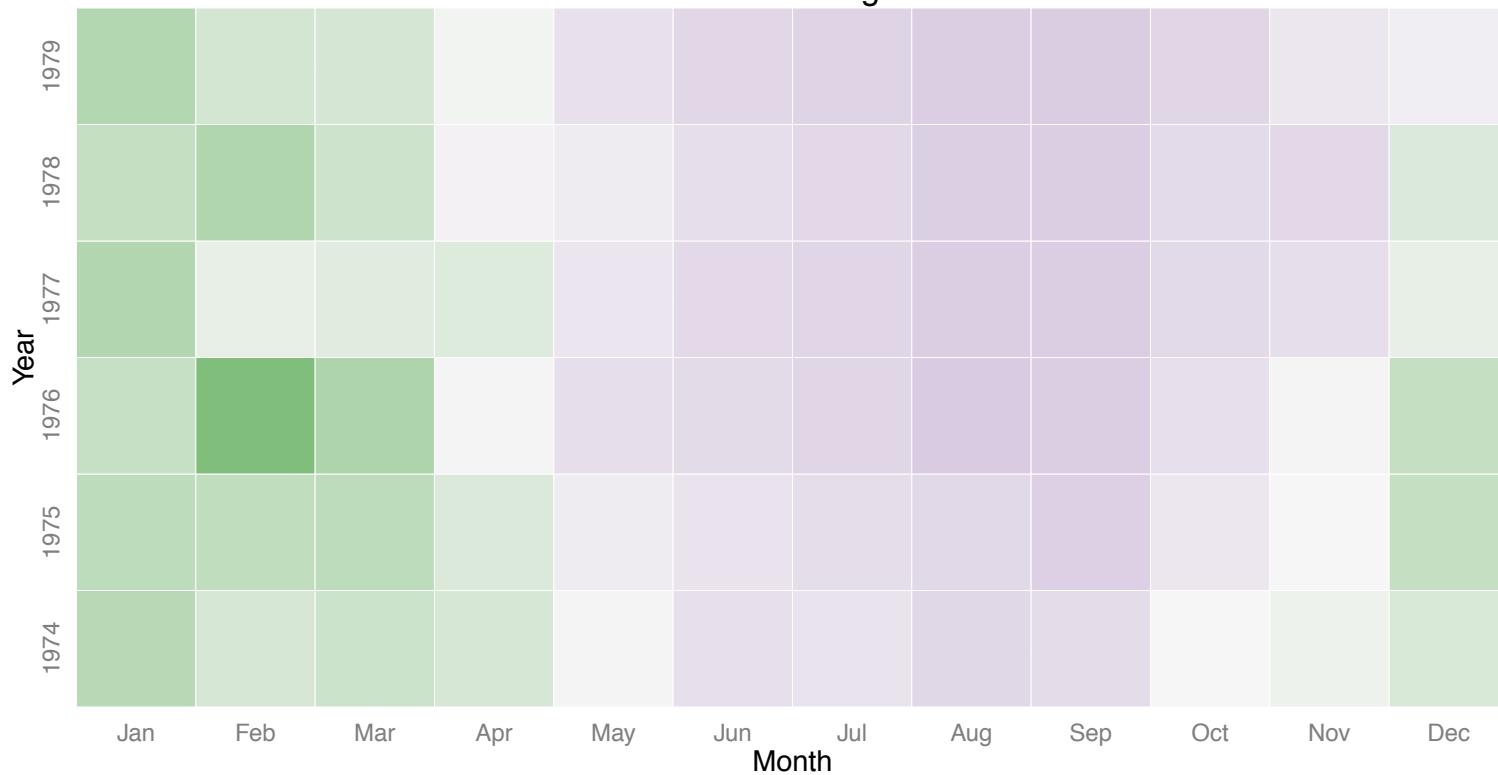
Multi-Line Plot

## UK Deaths from Lung Diseases



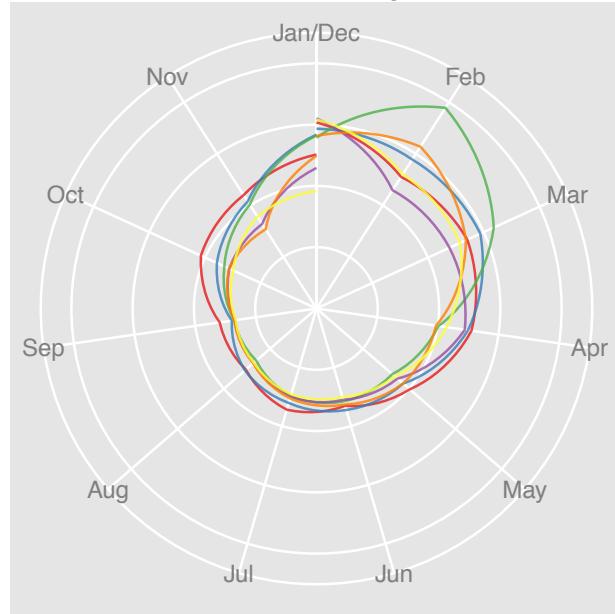
Small Multiples Plot

## UK Deaths from Lung Diseases



Heatmap

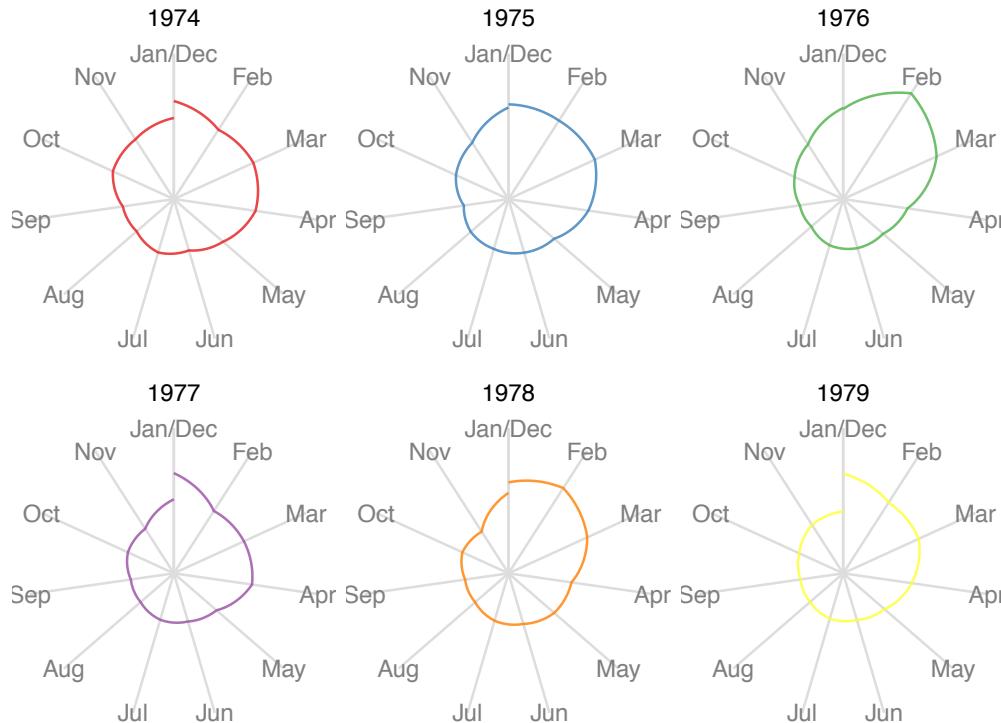
## UK Deaths from Lung Diseases



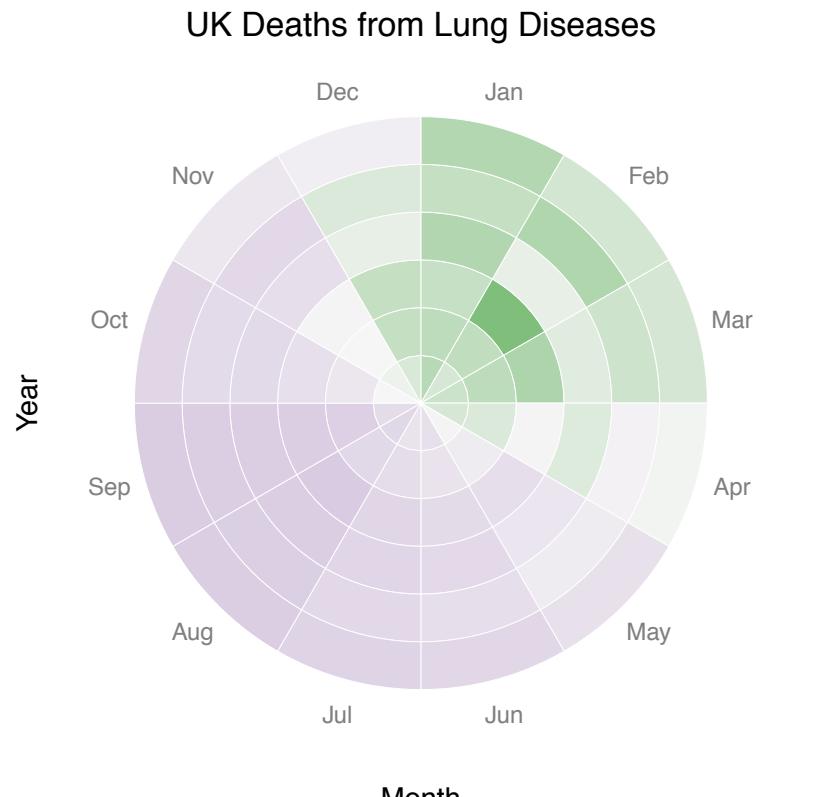
— 1974 — 1975 — 1976 — 1977 — 1978 — 1979

Star Plot\*

## UK Deaths from Lung Diseases

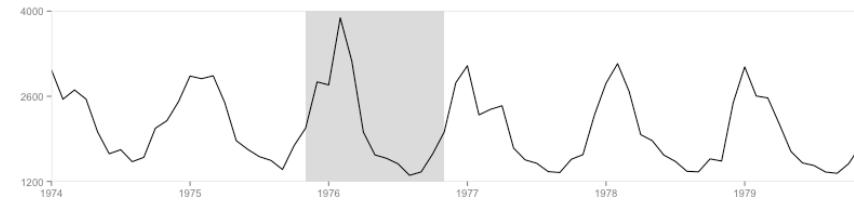
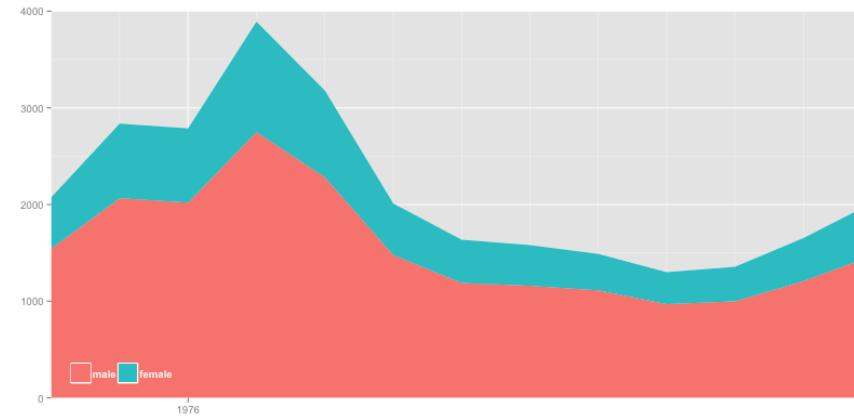
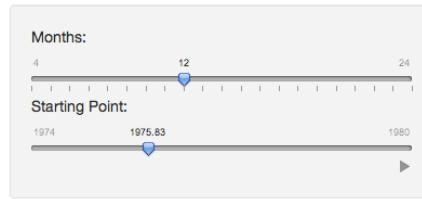


Small Multiple Star Plots\*



Circle View • <http://dl.acm.org/citation.cfm?doid=989863.989891>

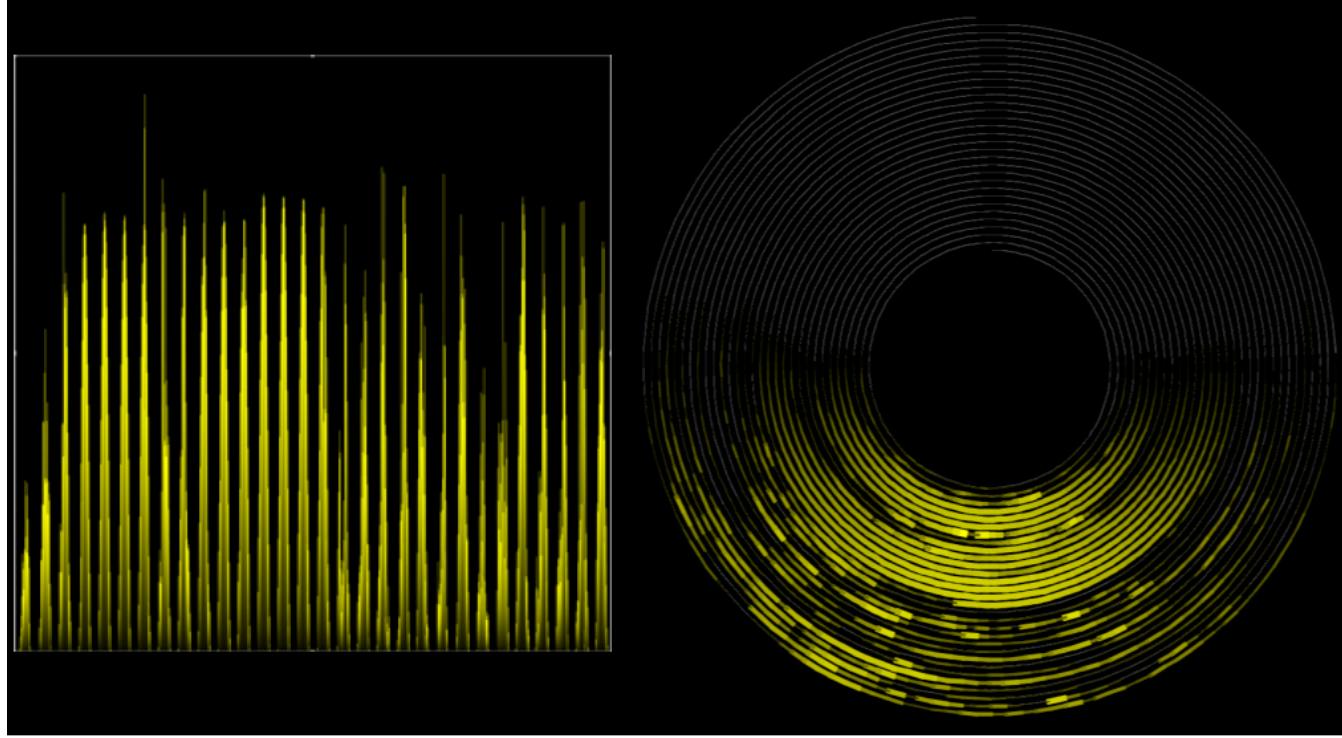
## UK Deaths from Lung Diseases



Animated Linked Views

# SHOWCASE

## Non-Animated Visualizations



**Figure 1: Two visualizations of sunshine intensity using about the same screen real estate and the same color coding scheme. In the spiral visualization it is much easier to compare days, to spot cloudy time periods, or to see events like sunrise and sunset.**

Sunshine Intensity • <http://dx.doi.org/10.1109/INFVIS.2001.963273>

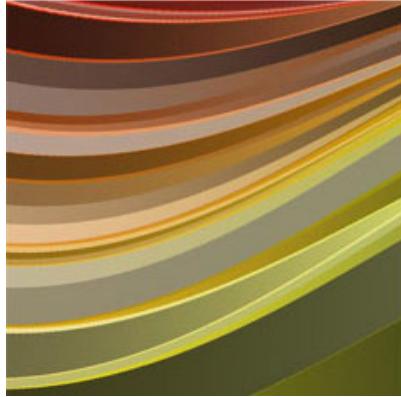
WINTER



SPRING



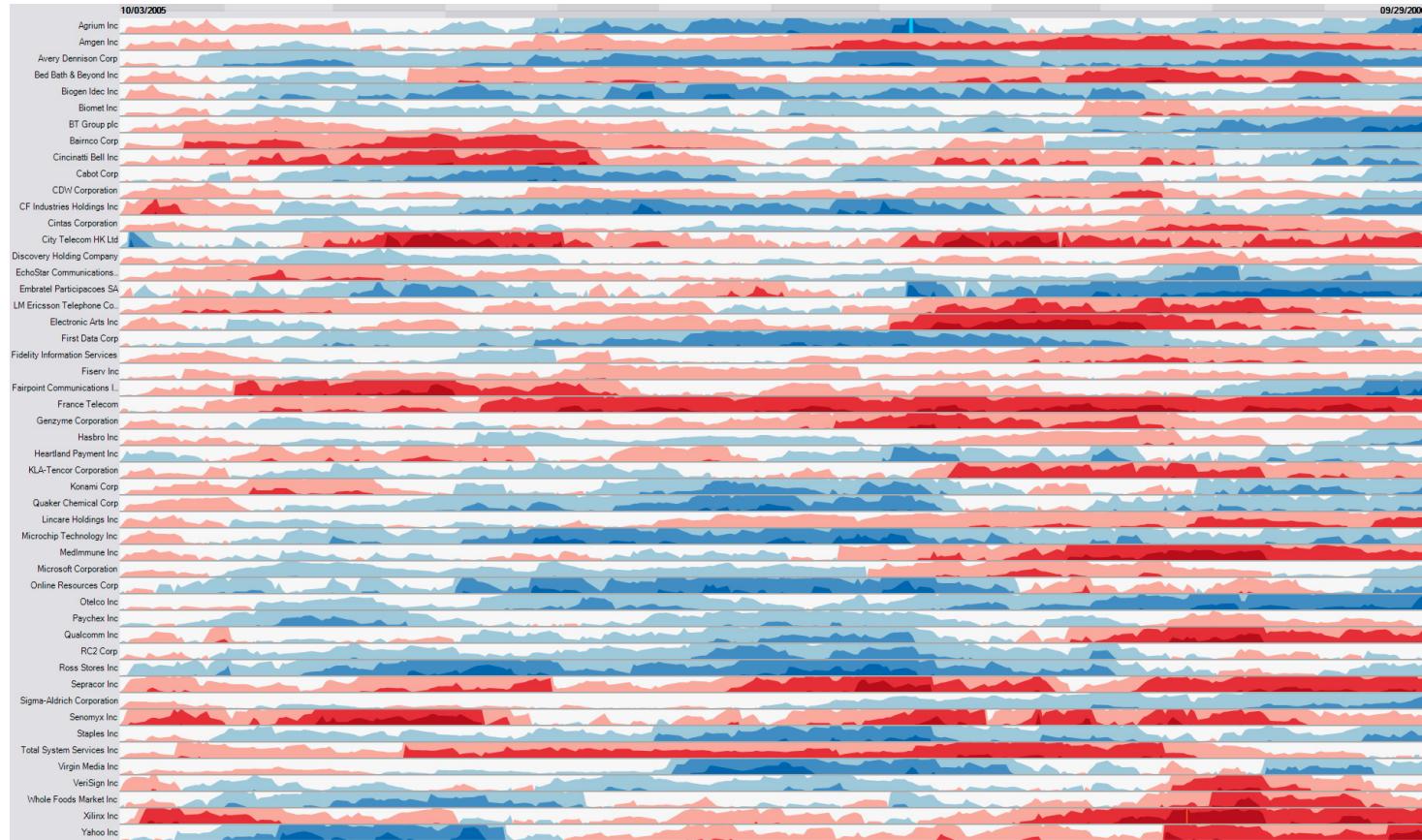
FALL



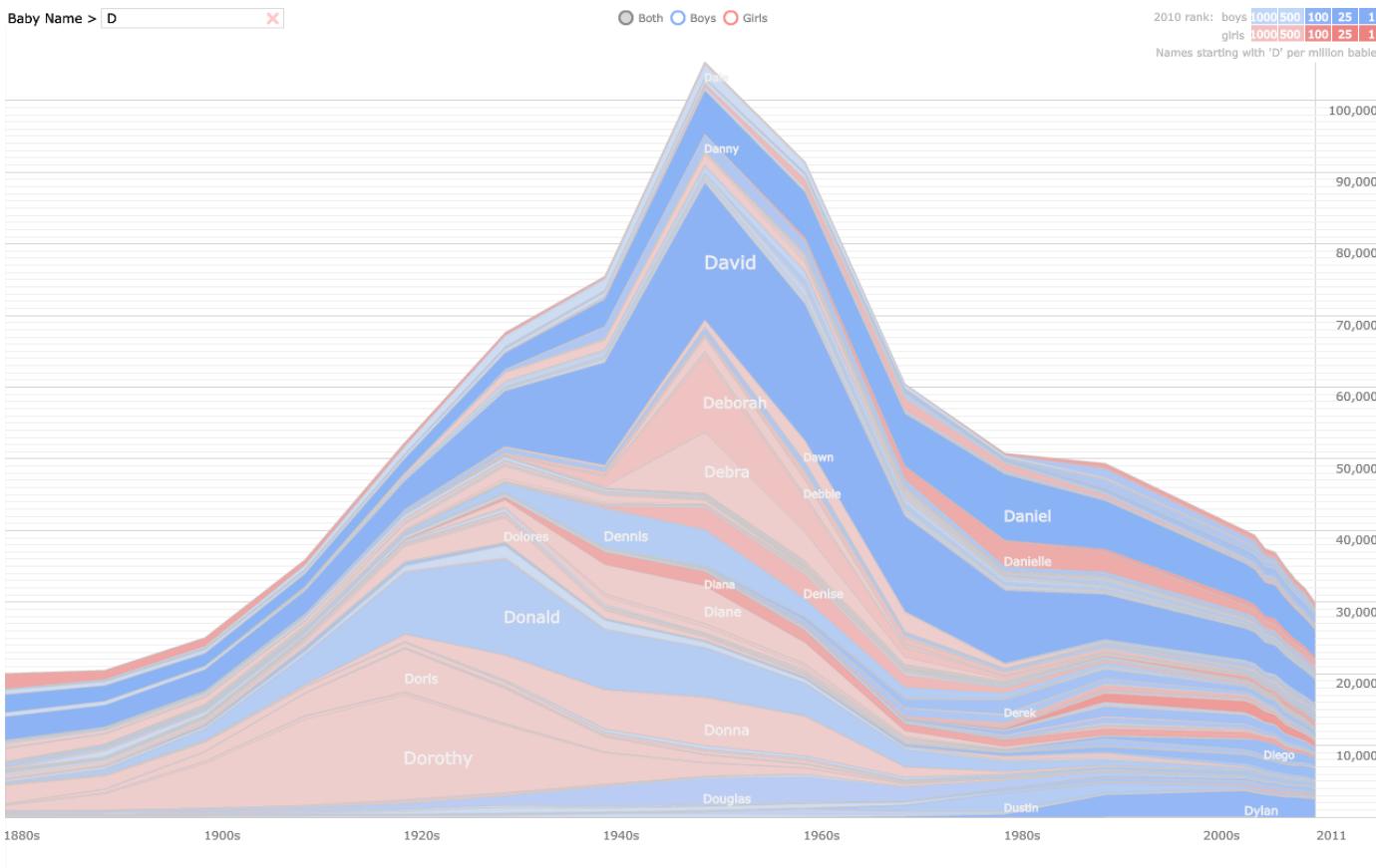
SUMMER



Flickr Flow • <http://hint.fm/projects/flickr/>



Horizon Graph • <http://www.perceptualedge.com/blog/?p=390>

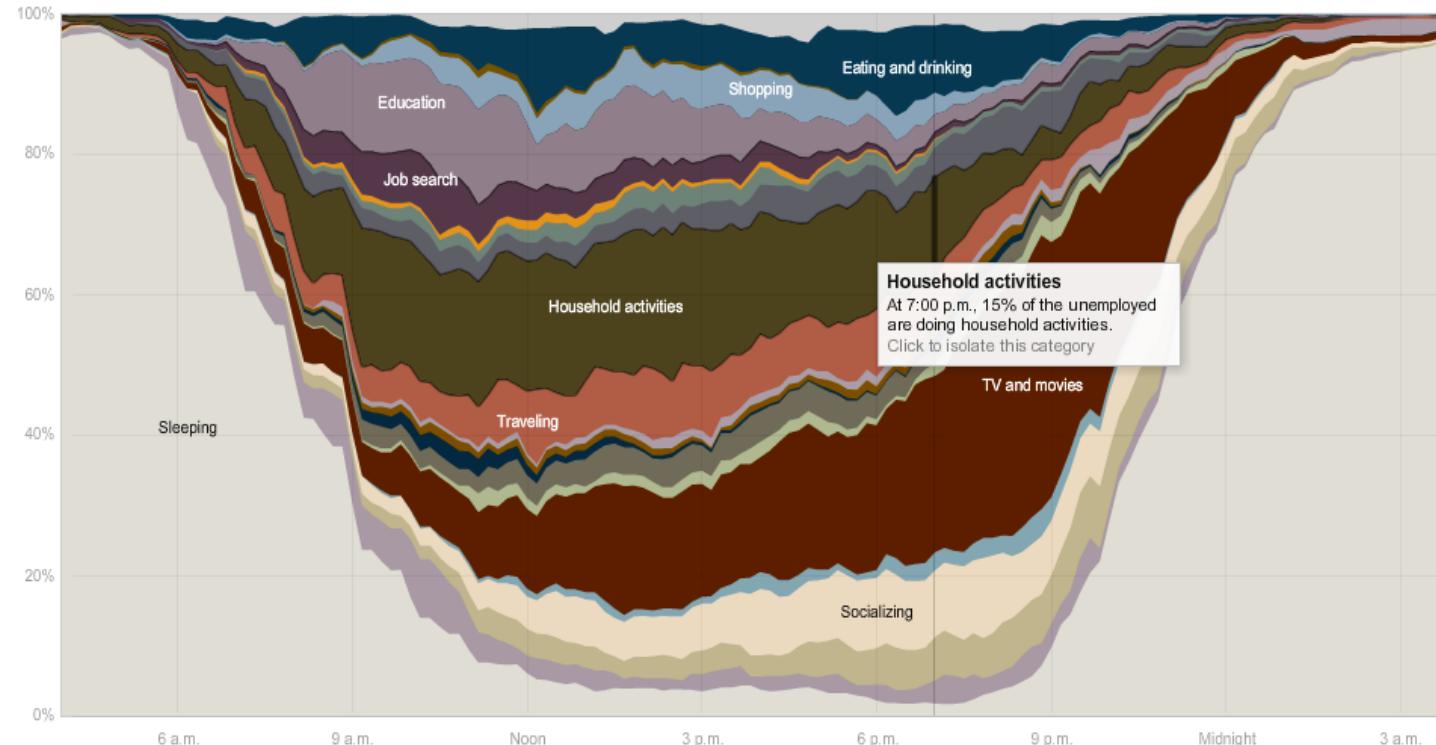


Baby Name Voyager • <http://www.babynamewizard.com/voyager>

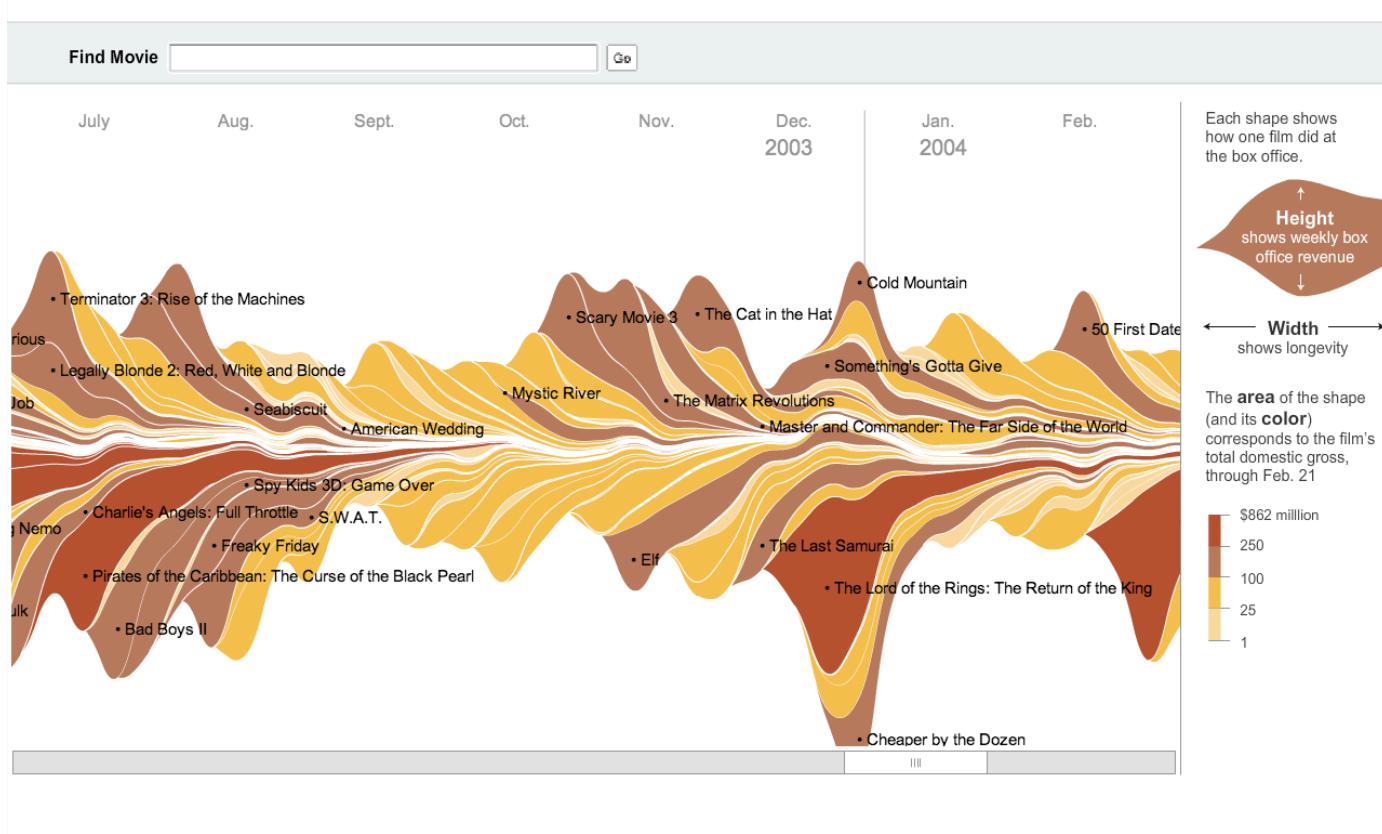
## The unemployed

On average, the unemployed spend about a half-hour looking for work. They tidy the house, do laundry and yard work for more than two hours, about an hour more than the employed.

Everyone	Employed	White	Age 15-24	H.S. grads	No children
Men	Unemployed	Black	Age 25-64	Bachelor's	One child
Women	Not in lab...	Hispanic	Age 65+	Advanced	Two+ children

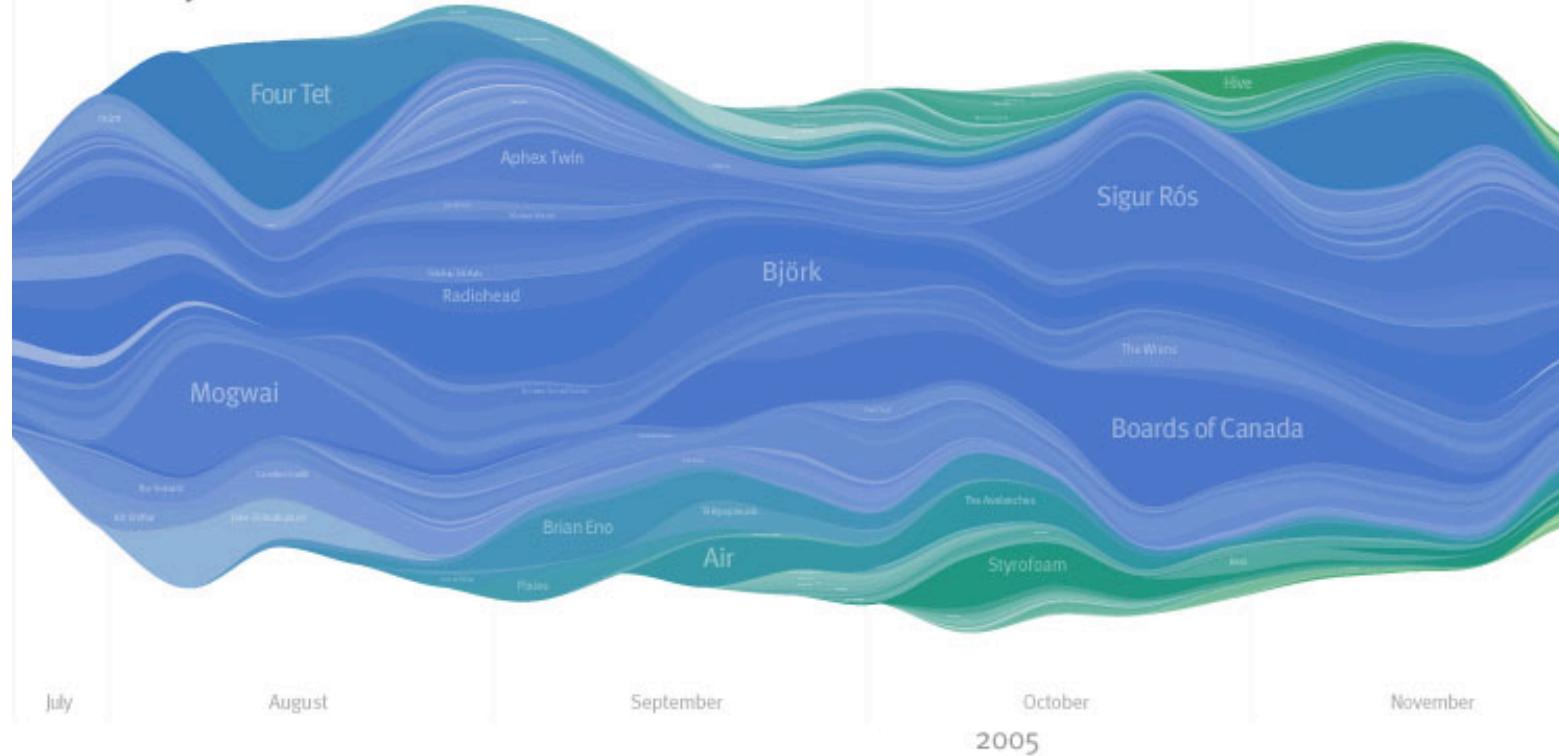


<http://www.nytimes.com/interactive/2009/07/31/business/20080801-metrics-graphic.html>



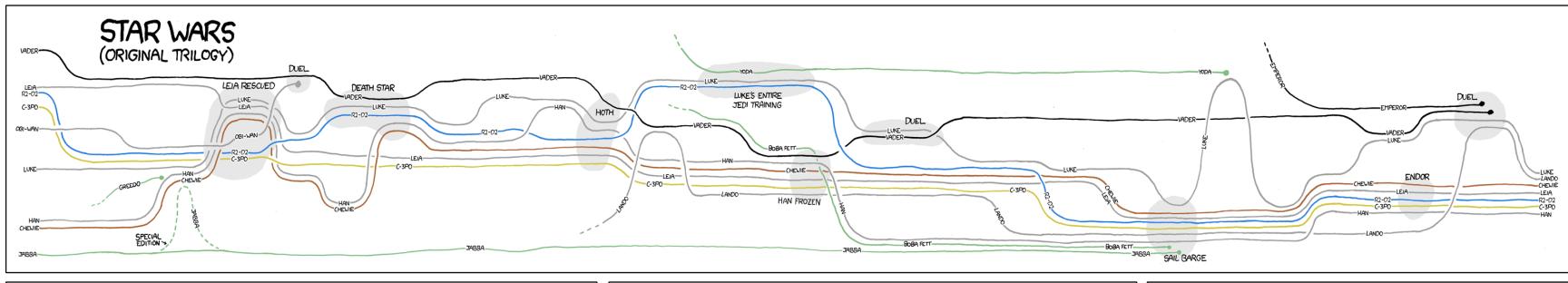
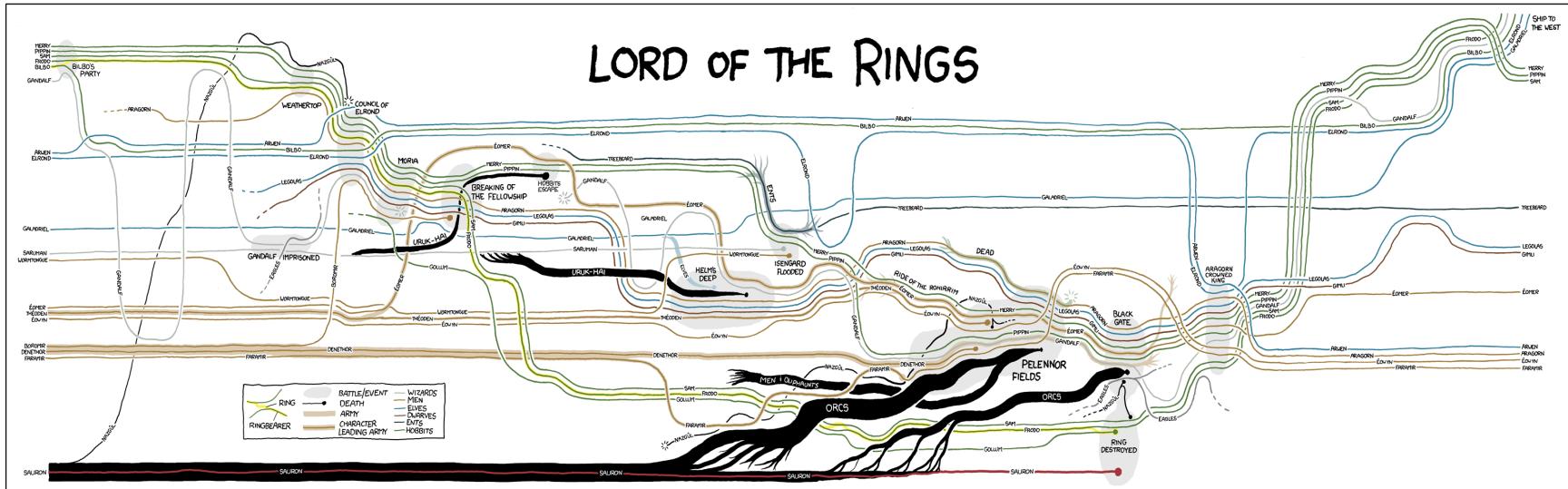
[http://www.nytimes.com/interactive/2008/02/23/movies/20080223\\_REVENUE\\_GRAPHIC.html](http://www.nytimes.com/interactive/2008/02/23/movies/20080223_REVENUE_GRAPHIC.html)

# Lee Byron

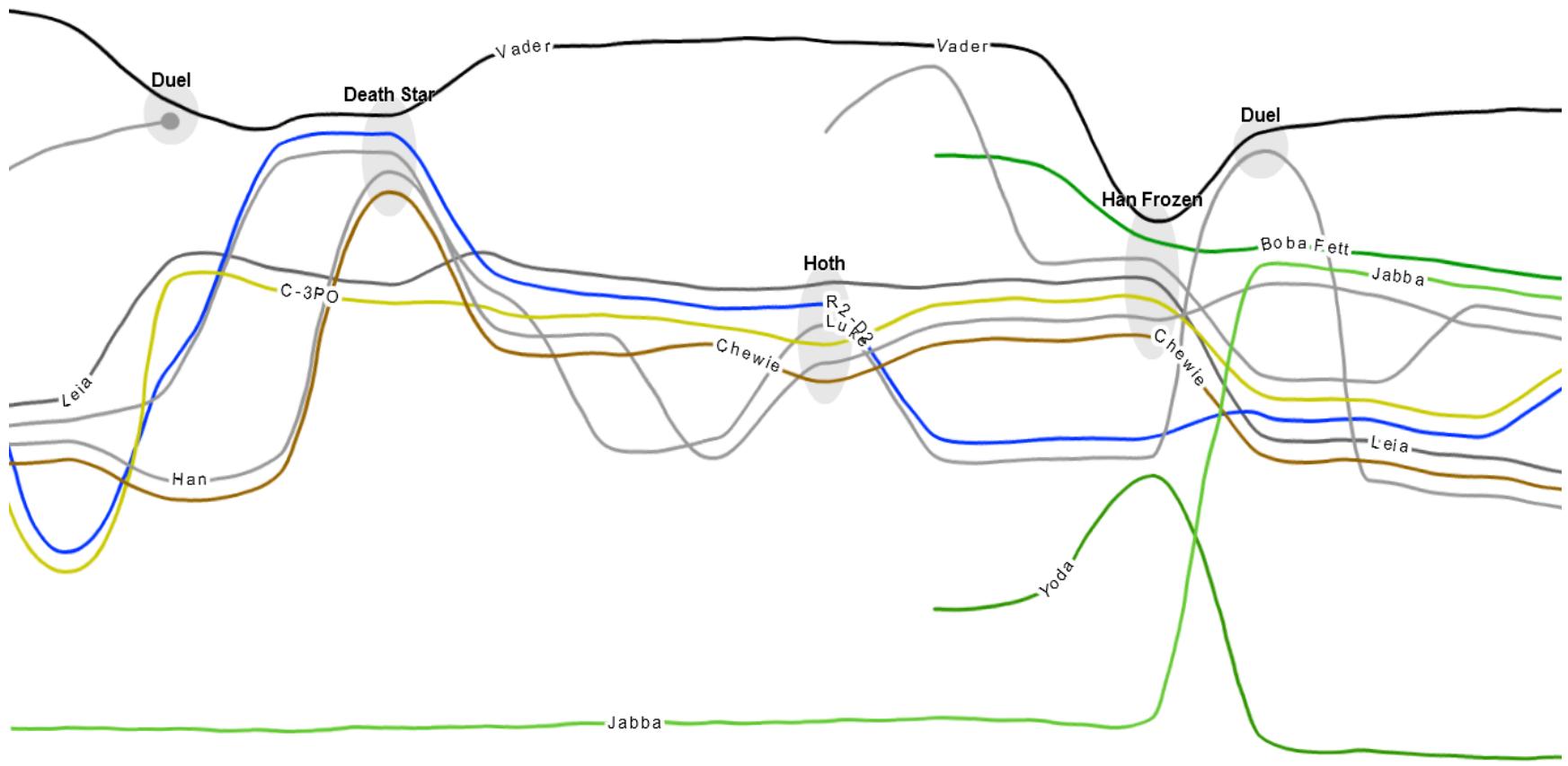


<http://www.leebyron.com/what/lastfm/>

# LORD OF THE RINGS



<http://xkcd.com/657/>



Plot Weaver • <http://ogievetsky.com/PlotWeaver/>

# SHOWCASE

## Animated Visualizations

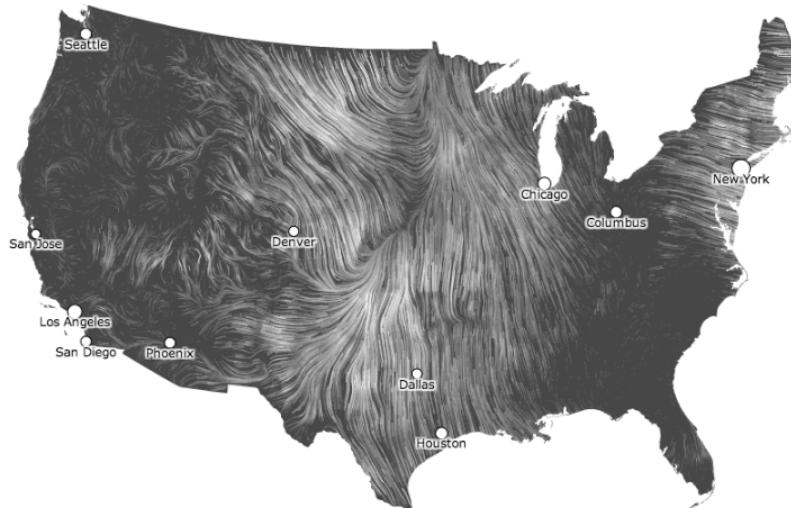
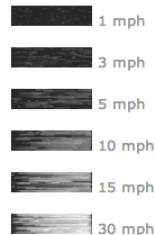
# wind map

**February 17, 2013**

11:59 pm EST

(time of forecast download)

top speed: **39.4 mph**  
average: **8.8 mph**



## Gallery

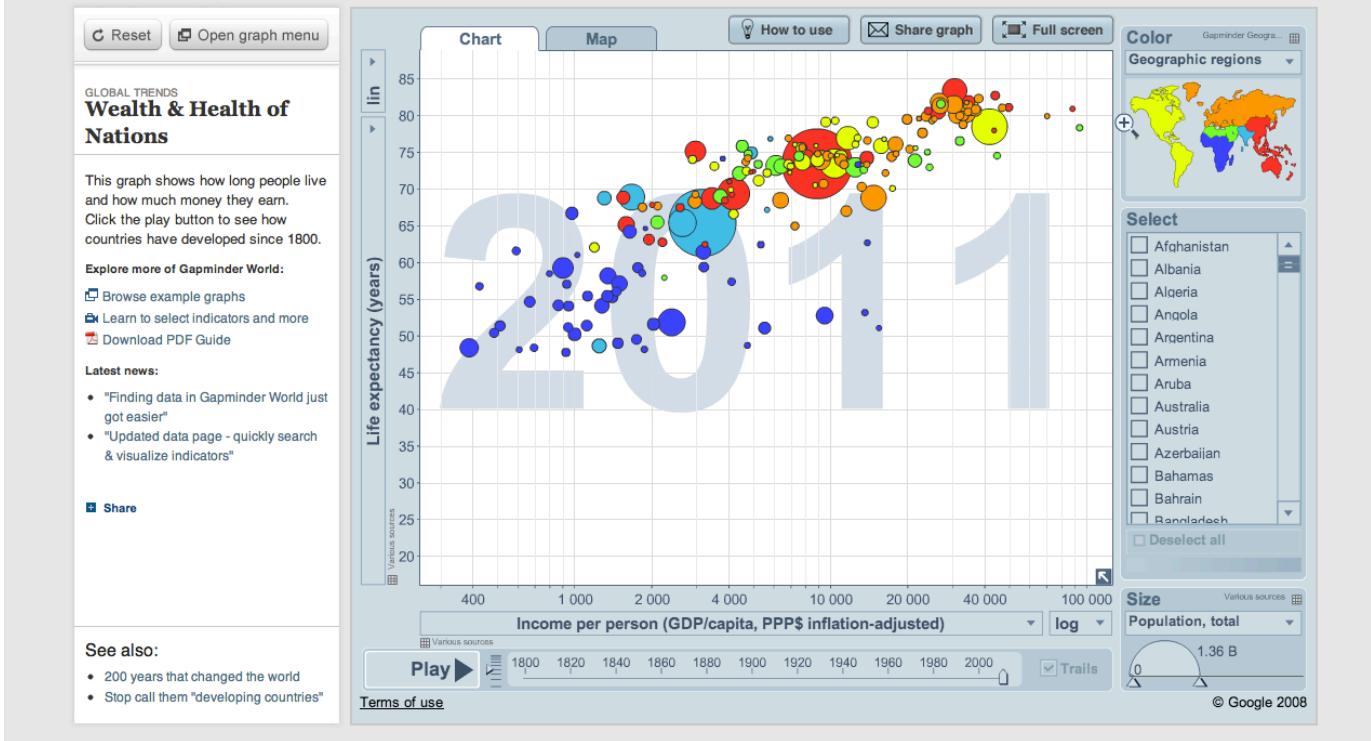


An invisible, ancient source of energy surrounds us—energy that powered the first explorations of the world, and that may be a key to the future. This map shows you the delicate tracery of wind flowing over the US.

[Donate to Hurricane Sandy relief efforts here.](#)

**NEW:** wind map prints are available from [Point.B Studio](#).

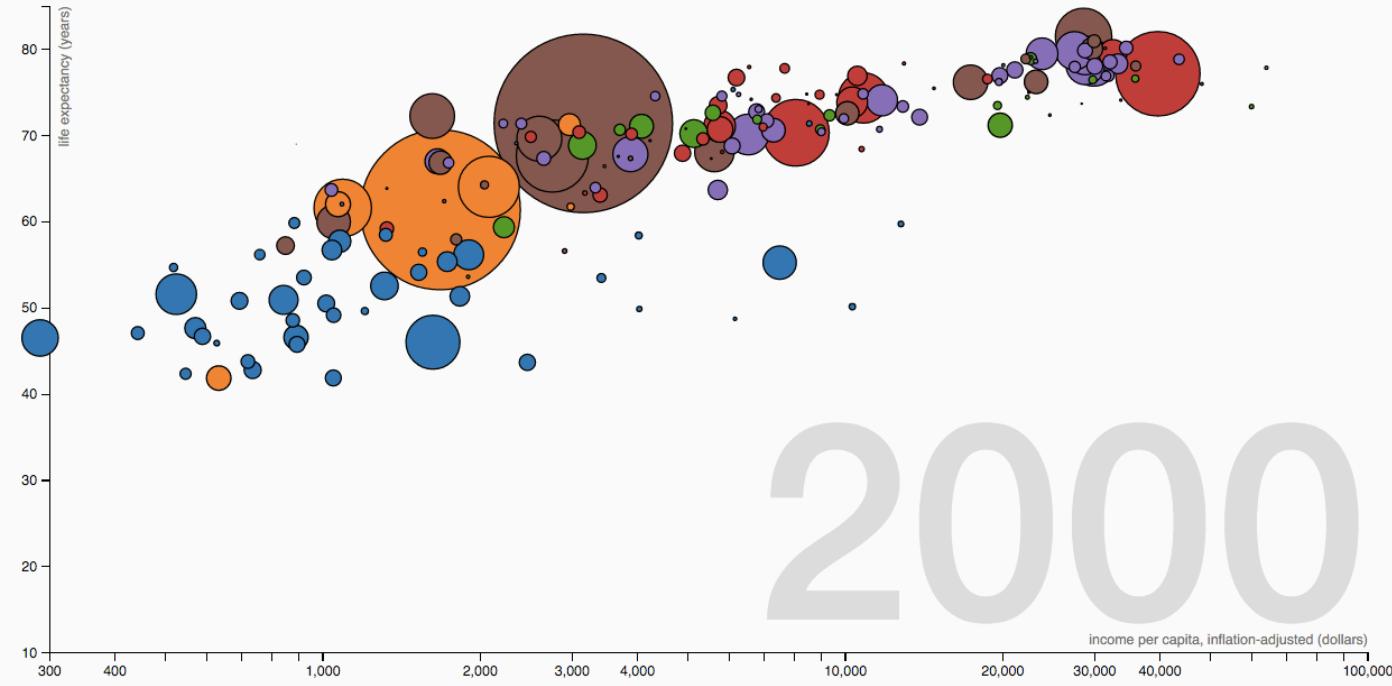
<http://hint.fm/wind/>



<http://www.gapminder.org/>



# The Wealth & Health of Nations



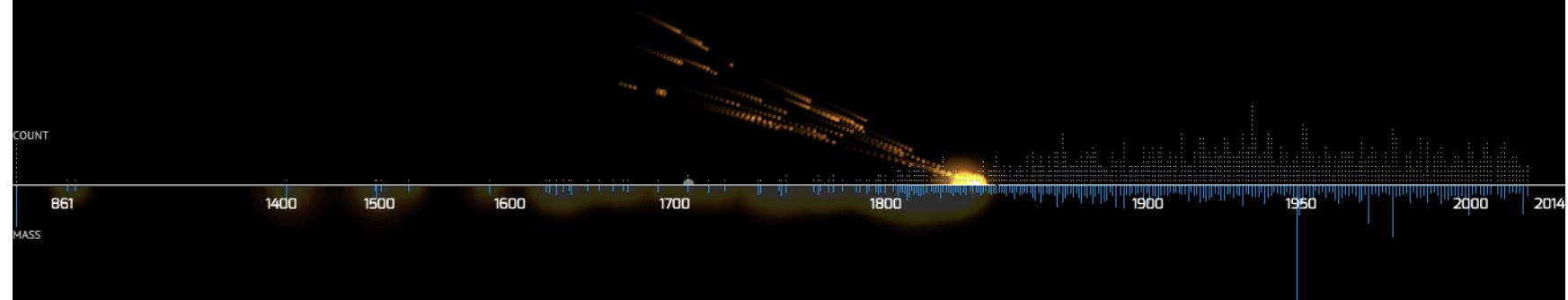
<https://bost.ocks.org/mike/nations/>



Code Swarm • [http://www.michaelogawa.com/code\\_swarm/](http://www.michaelogawa.com/code_swarm/)



AS OF 1850,  
169 METEORITES  
WERE EYE-WITNESSED

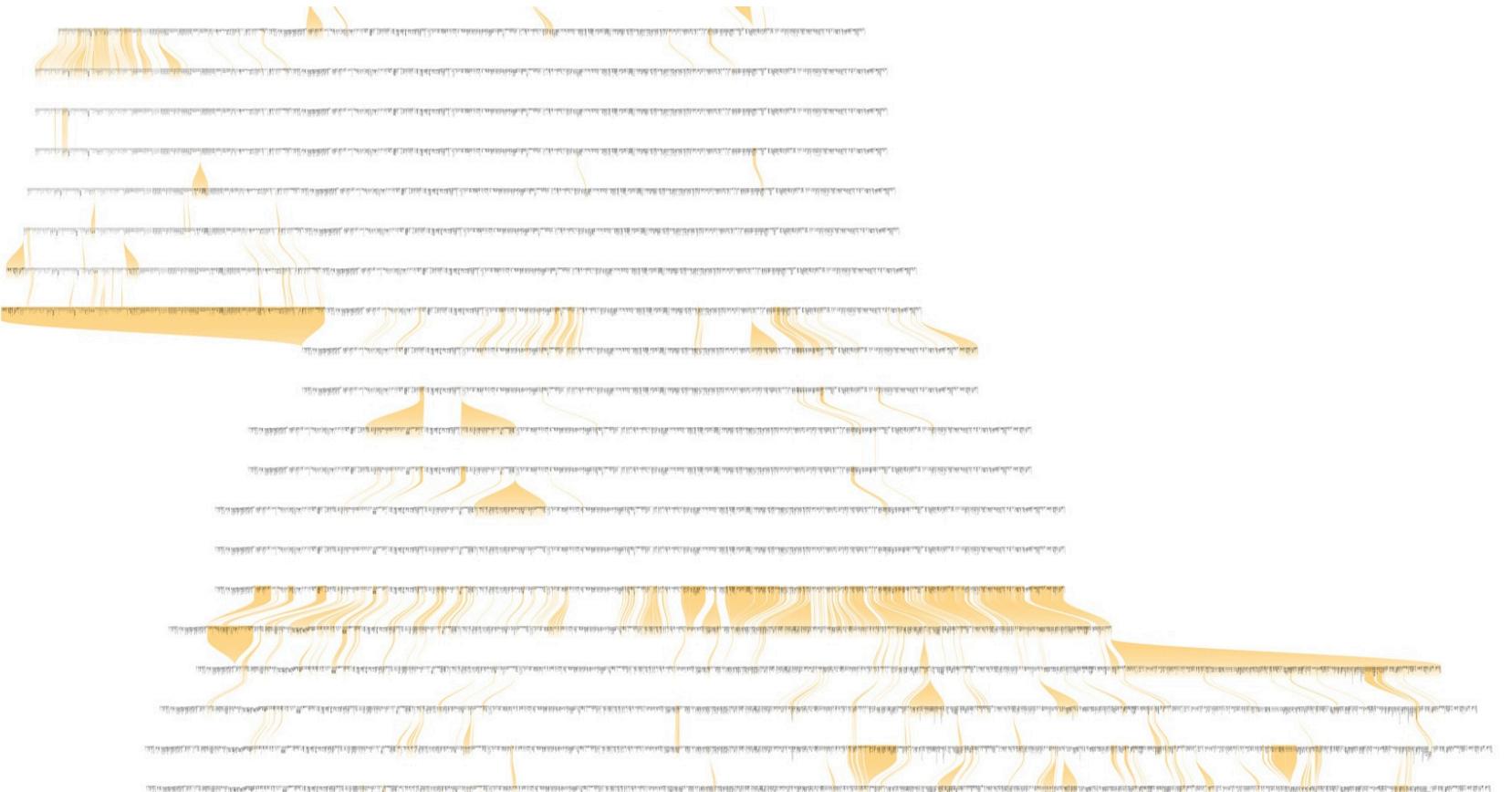


THOUSANDS OF METEORITES HAVE COLLIDED WITH THE EARTH SINCE 2500 BC.  
MORE THAN 45,000 HAVE BEEN RECORDED. ONLY 1,123 HAVE BEEN SEEN FALLING.

<http://bolid.es/>

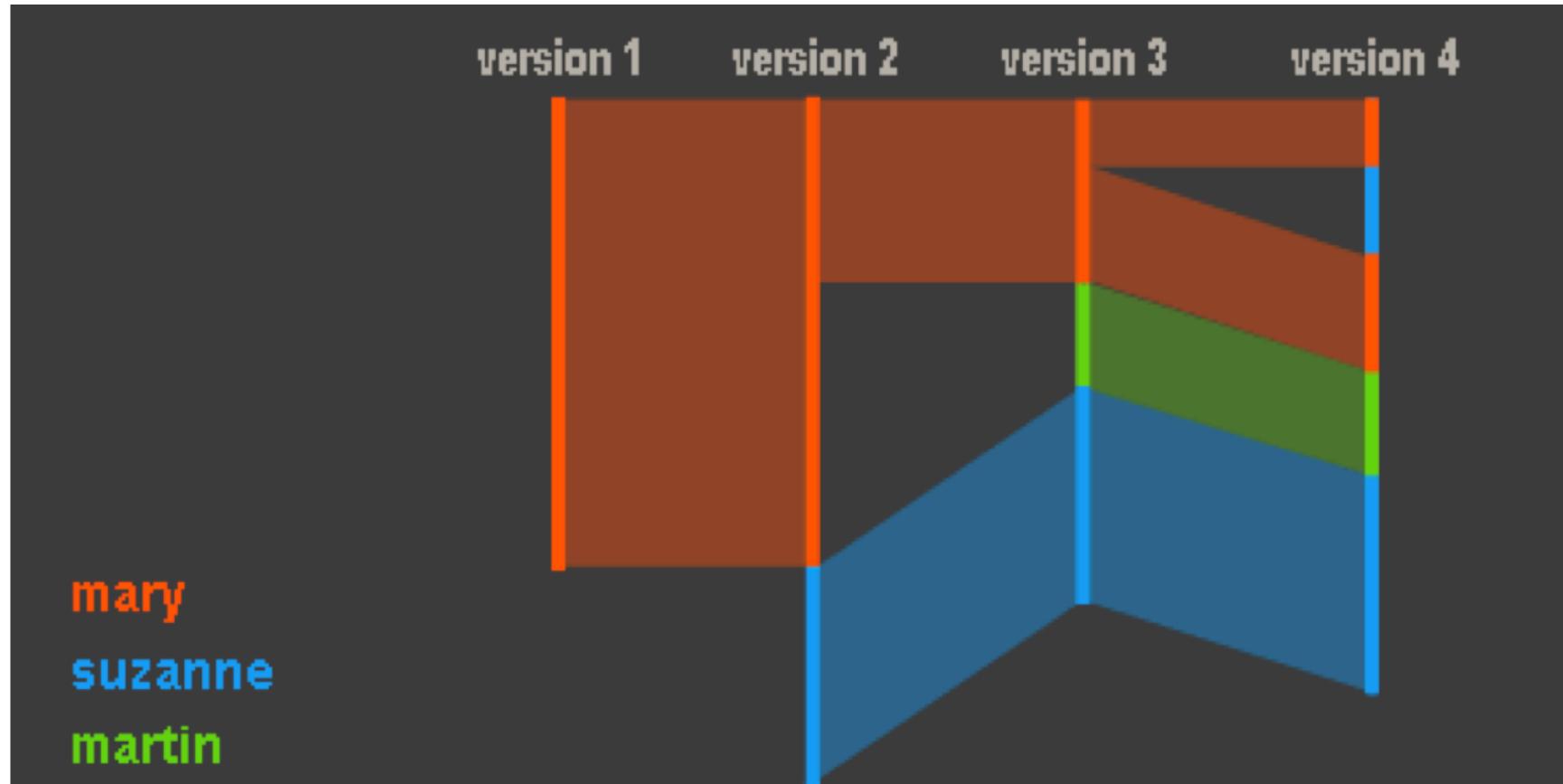
# SHOWCASE

## Revision Visualization

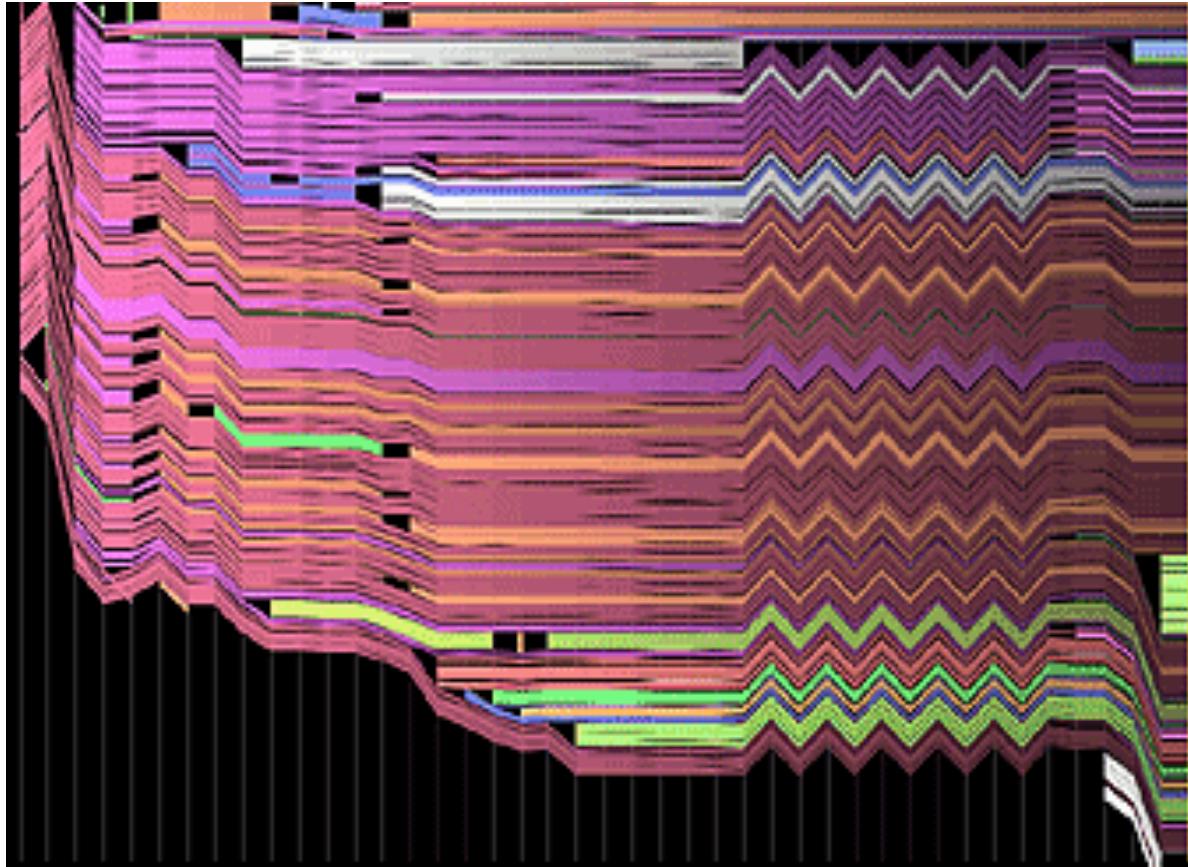


Revisionist • <http://benfry.com/revisionist/>

Revisionist • <http://benfry.com/revisionist/>



History Flow • <http://hint.fm/projects/historyflow/>



History Flow • <http://hint.fm/projects/historyflow/>

chocolate is a common ingredient in many kinds of sweets -- one of the most popular in the world -- made from the fermented, roasted, and ground seeds of the tropical cacao tree (*Theobroma cacao*). Dictionaries refer to this cacao substance as "chocolate," which is an intensely flavored bitter (not sweet) food, although this is legally defined as cacao in many countries. This is usually sweetened with sugar and other ingredients and made into chocolate bars (the substance of which is also commonly referred to as chocolate), or beverages (called cacao or hot chocolate).

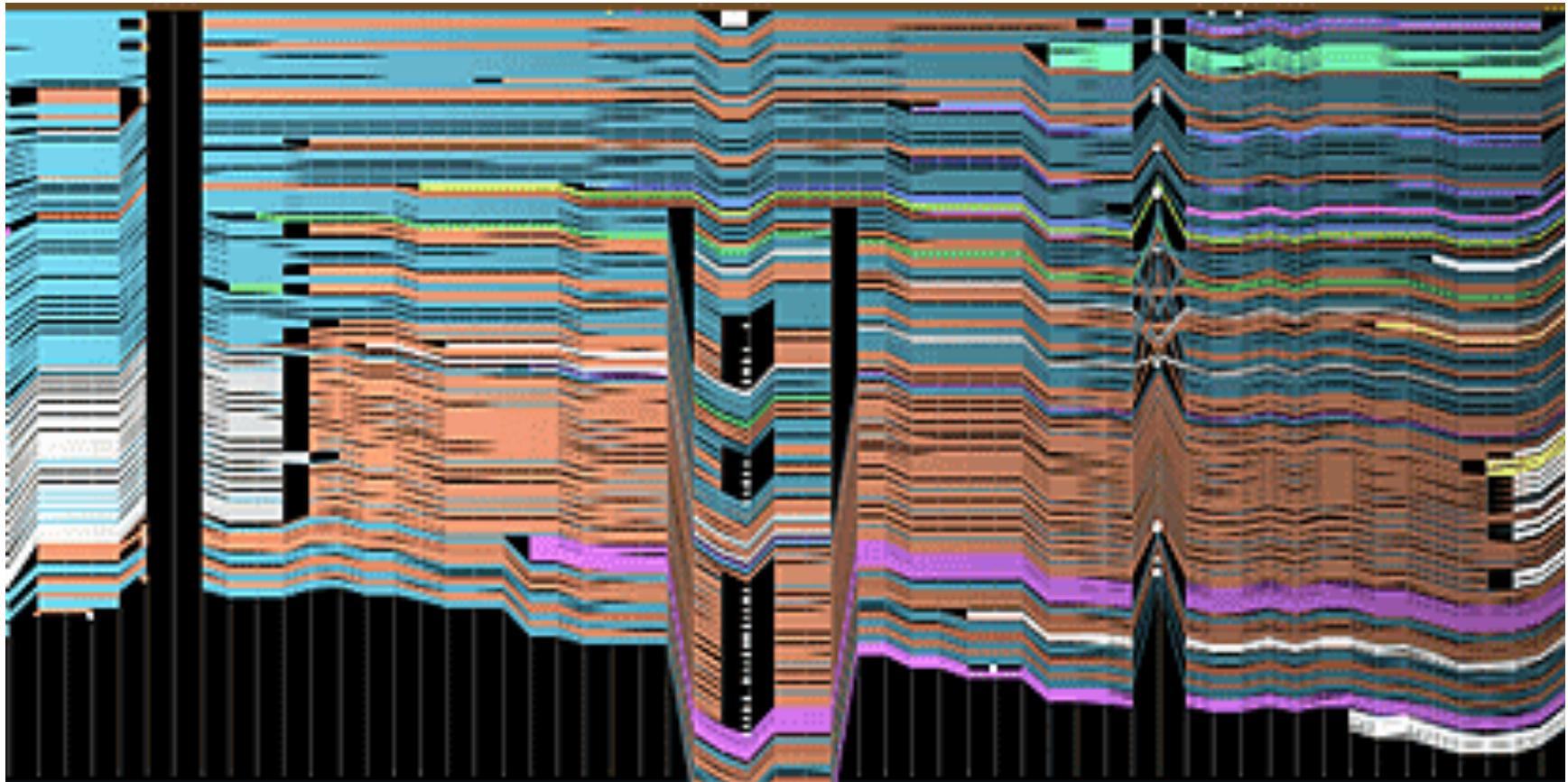
Chocolate is often produced in the form of little sculptures, for example as Easter- or egg-shaped chocolates, near a holiday in many countries called Easter.

Table of contents showToggle("show","hide")

- 1 Different kinds of chocolate
- 2 The history of chocolate
- 3 Chocolate as a stimulant
- 4 Why chocolate tastes so good
- 5 How chocolate is made
- 6 Chocolate in the media
- 7 External links

### Different kinds of chocolate

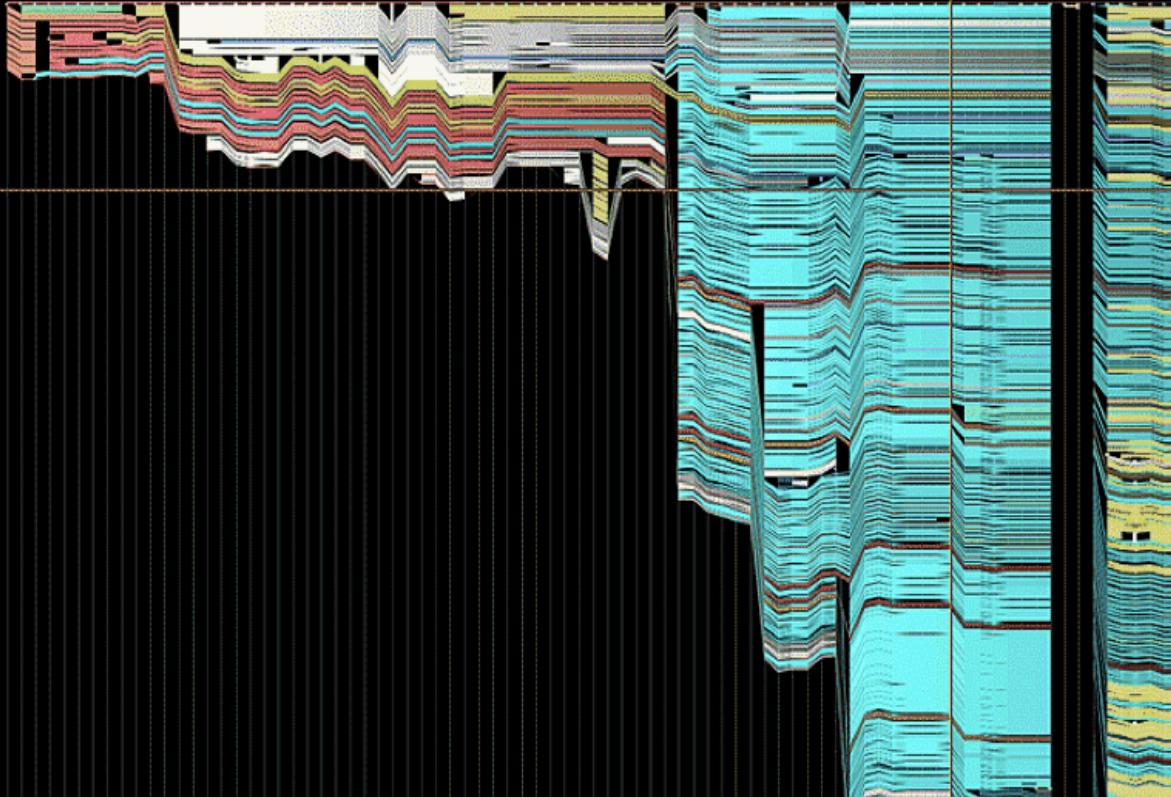
Chocolate is an extremely popular ingredient, available in many types, and great variety. Different forms and flavors of chocolate are usually produced by varying the amount of the ingredients used to make the chocolate.



History Flow • <http://hint.fm/projects/historyflow/>

## authors

Conversion script	1
Elion WEBER	1
Ihemands	5
Ed Poor	2
Koyearnis-Qelci	1
I-Apali	1
Scolopus	2
Omnist	1
Andre Engels	1
Rhendon	1
TUXKAT	1
Danny	1
Giffam	1
The Anome	1
Theanthrope	2
Velus	1
BrianHansen	1
Tewi	1
WestNix	1
Xyloas	1
Arthiere	3
LittleDan	1
Dietary Fiber	5
Intemennissa	1
Fonyz	8
Heron	1
Ed Poor-Yorick	1
Klytheruser	1
Migil	2
Rawr	1
Patrick	1
Merico	1
Iay	1
Spottell	1
Ahoerstemeier	1
Meng	1
Fannin	1
Oprompt	1



Egi "Karbala"-Bgt; Karbala"

The fertile area of Mesopotamia, between the Euphrates and the Tigris rivers, was the birth place of several of the world's oldest civilizations, such as the Sumerians, Babylonians and Assyrians. After being part of Persia for a long time, it was conquered by the Arabs in 636, and in 762 the Caliphate was moved to the new city of Baghdad (near ancient Babylon). This city remained the centre of the Arab world until it was incorporated by the Ottomans in 1516. In 1915, British troops occupied Iraq and established a League of Nations mandate, which ended with independence in 1932. The socialist Ba'ath Party gained control in 1968, and established a strict rule. In the 1980s, Iraq was involved in a long war with neighbour Iran, ending in 1988. Following the 1990 occupation of Kuwait, and the subsequent expulsion by international troops, Iraq became internationally isolated.

## Politics Main article: Politics of Iraq

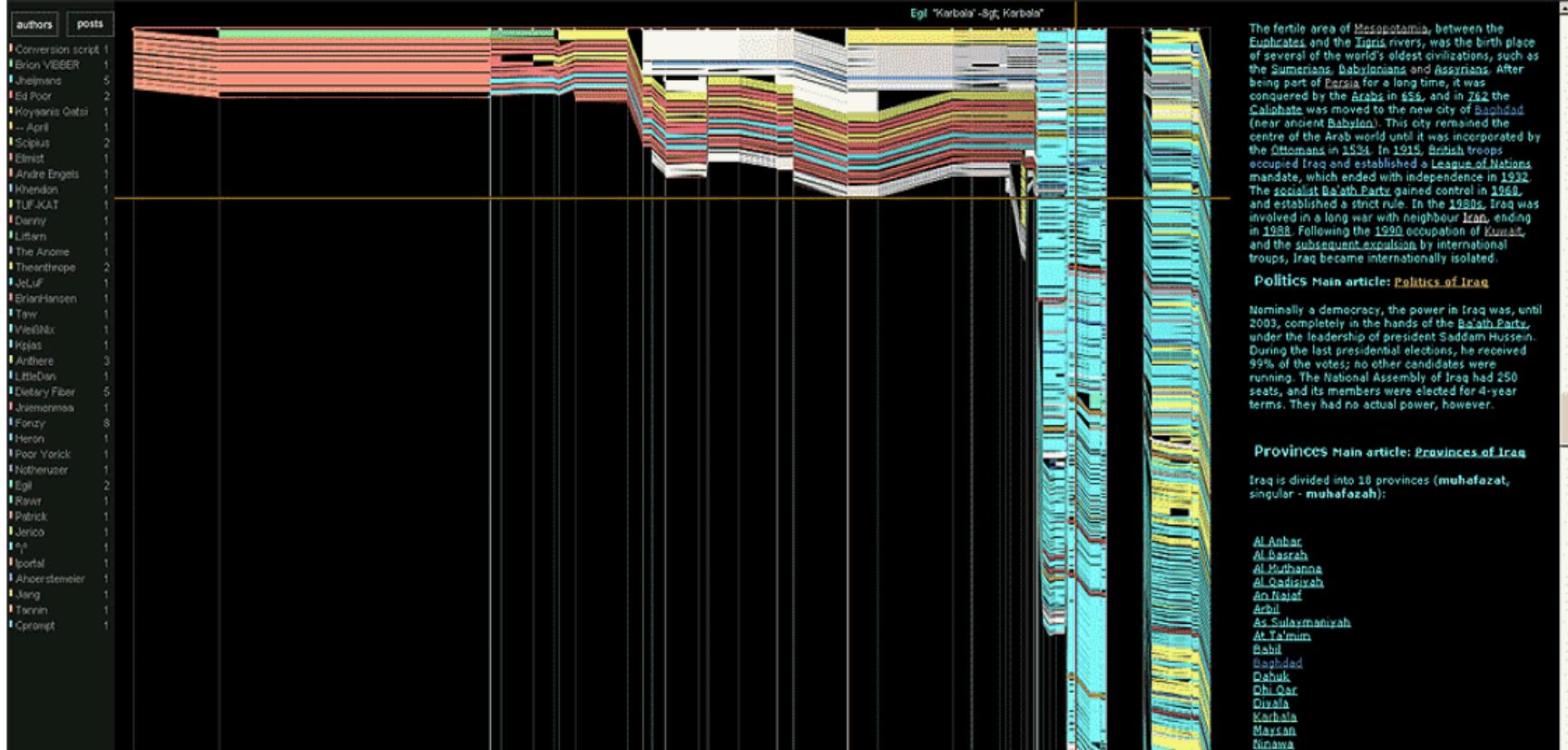
Nominally a democracy, the power in Iraq was, until 2003, completely in the hands of the Ba'ath Party, under the leadership of president Saddam Hussein. During the last presidential elections, he received 99% of the votes; no other candidates were running. The National Assembly of Iraq had 250 seats, and its members were elected for 4-year terms. They had no actual power, however.

## Provinces Main article: Provinces of Iraq

Iraq is divided into 18 provinces (muhafazat, singular - muhafazah):

- Al Anbar
- Al Basrah
- Al Muthanna
- Al Qadisiyah
- An Najaf
- Arbil
- As Sulaymaniyah
- At Ta'mim
- Babyl
- Baghdad
- Dhi Qar
- Diyala
- Karbala
- Maysan
- Ninawa

History Flow • <http://hint.fm/projects/historyflow/>



History Flow • <http://hint.fm/projects/historyflow/>

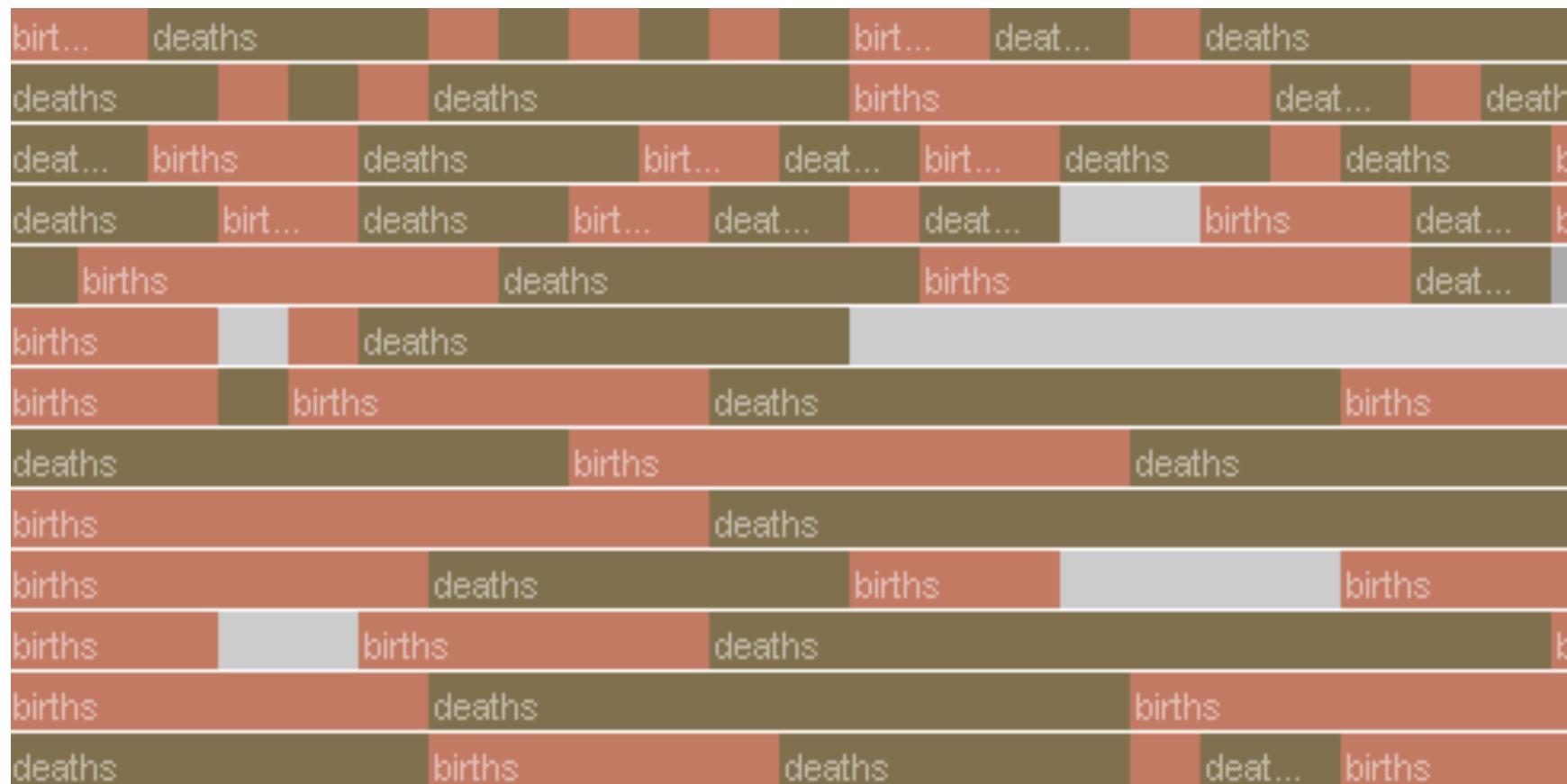
May 22, 3:00 pm	Mathematics	Revert
May 24, 11:21 am	Fields Medal	2006 data
May 24, 11:25 am	Talk:Fractal	List of proposed changes
May 24, 11:27 am	Talk:Fractal	List of proposed changes
May 25, 10:13 am	Sphere	Fix tpyo
May 25, 10:23 am	mercator.png	Copyright

**b**

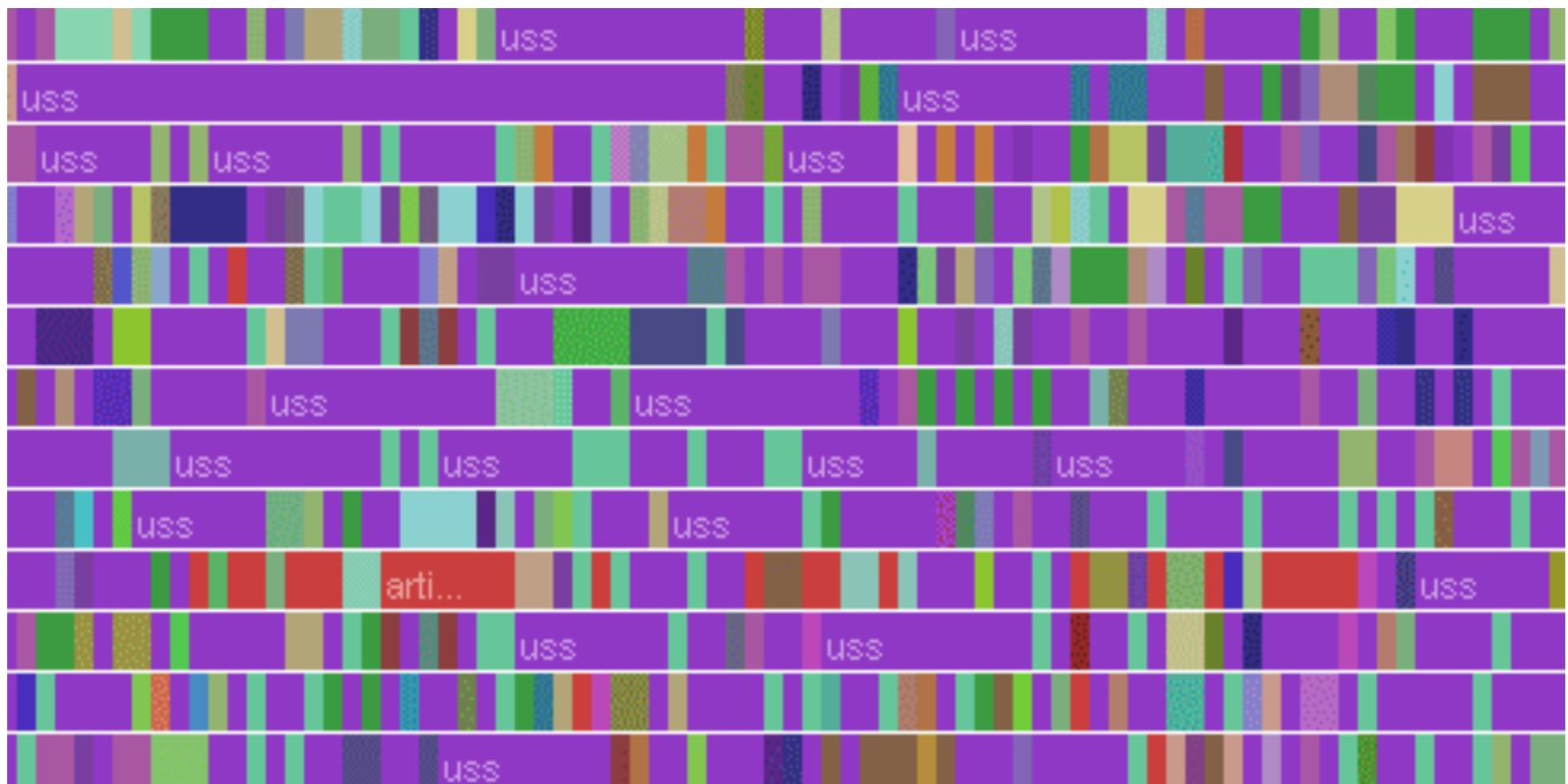
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24	2006 data	List of proposed changes	Fix tpyo	Copyright	

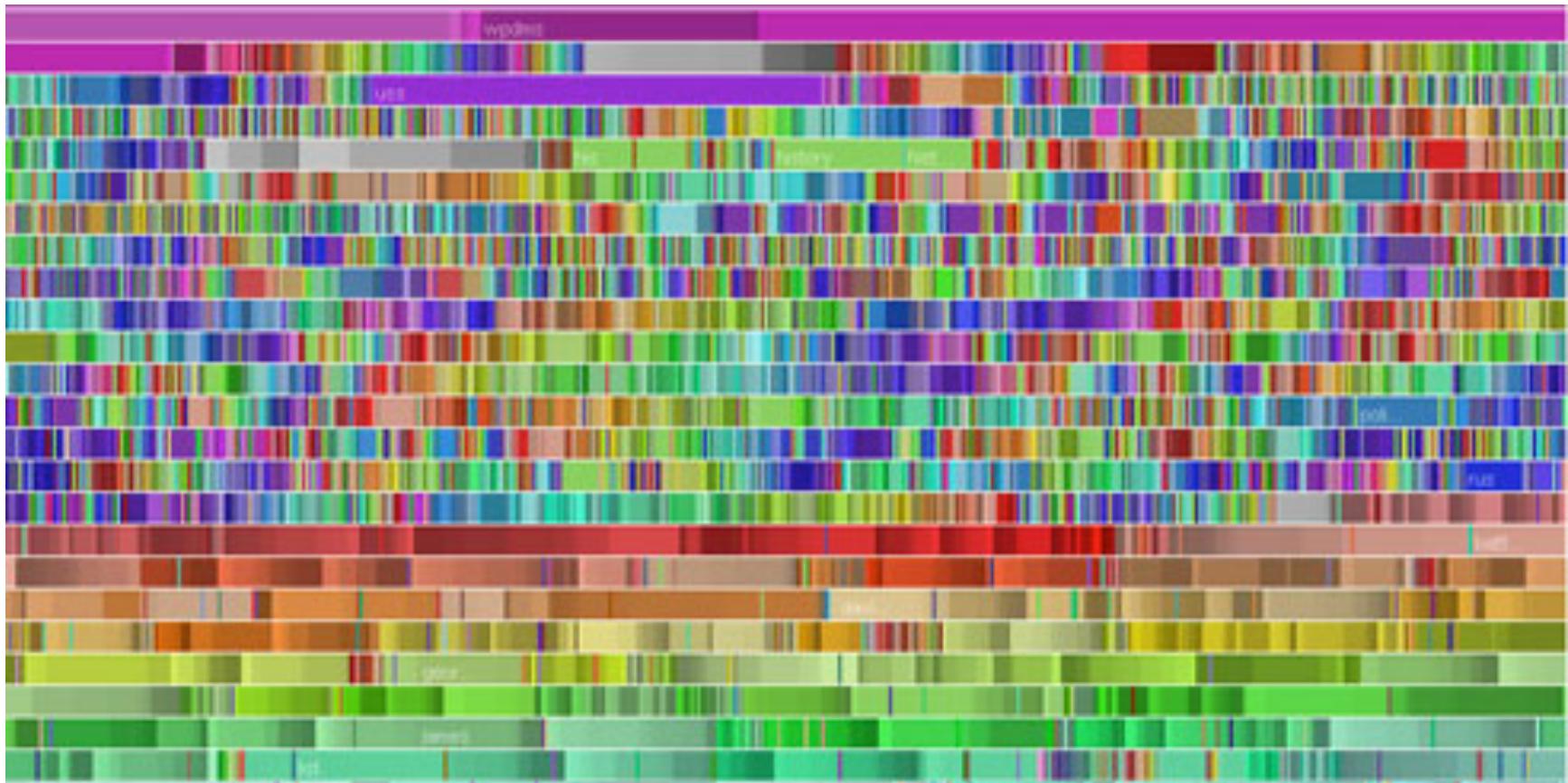
Chromogram • <http://hint.fm/projects/chromogram/>



Chromogram • <http://hint.fm/projects/chromogram/>



Chromogram • <http://hint.fm/projects/chromogram/>



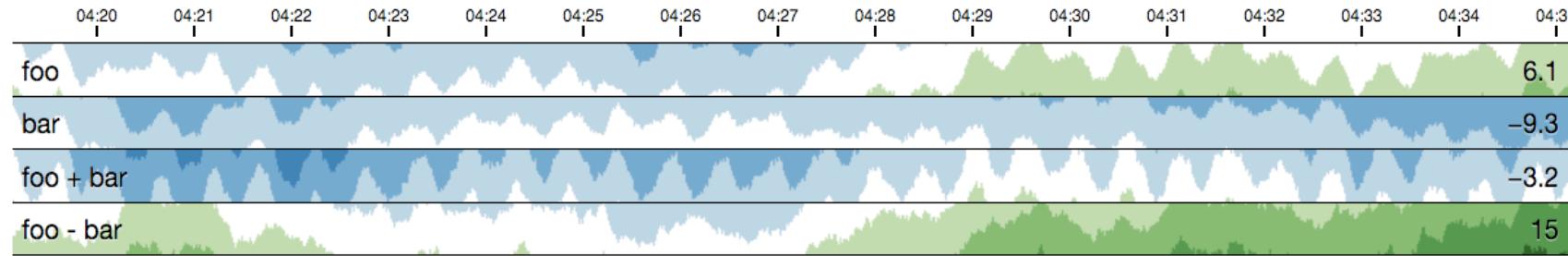
Chromogram • <http://hint.fm/projects/chromogram/>

# SHOWCASE

## Tools for Time Series

# Cubism.js

## Time Series Visualization



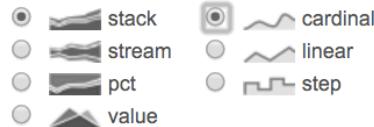
Mouseover or use the arrow  
keys to inspect values.  
[Open in a new window.](#)

**Cubism.js** is a [D3](#) plugin for visualizing time series. Use Cubism to construct better realtime dashboards, pulling data from [Graphite](#), [Cube](#) and other sources. Cubism is available under the [Apache License](#) on [GitHub](#).

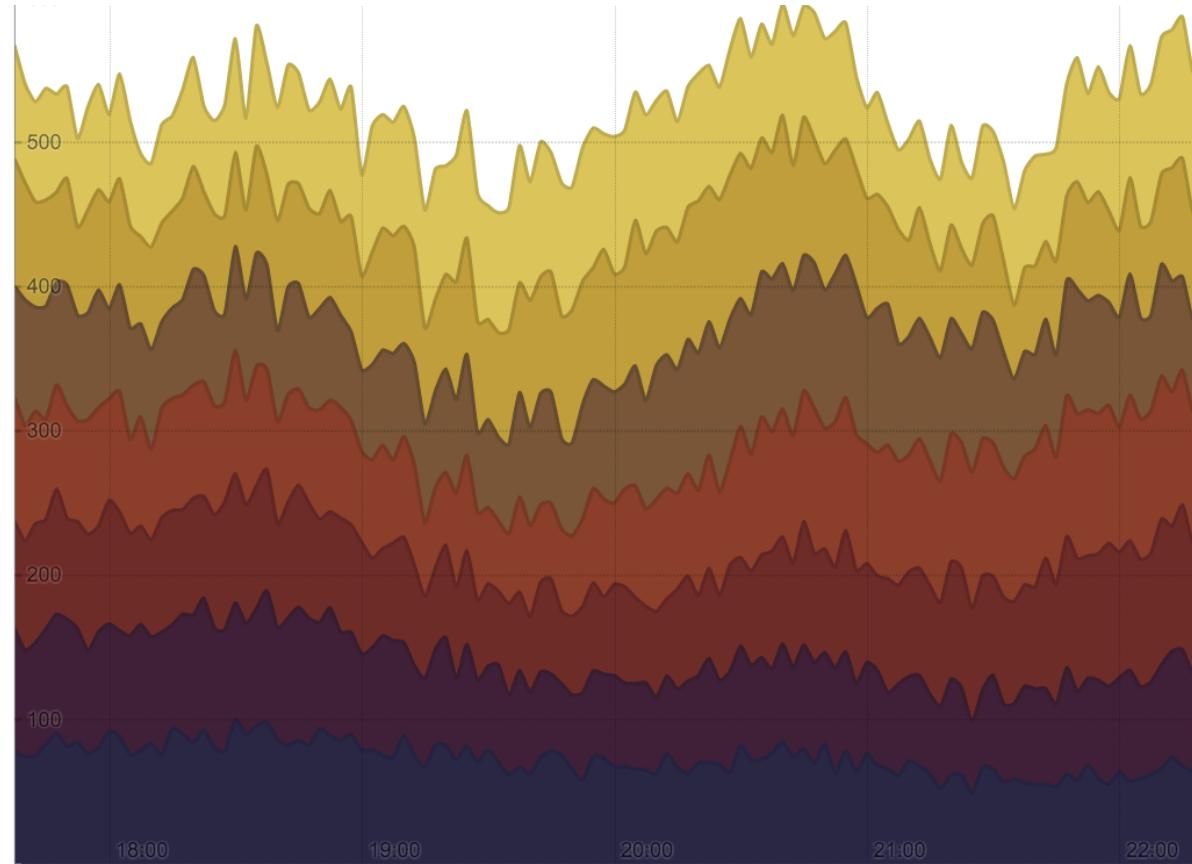
<https://square.github.io/cubism/>

## Random Data in the Future

- New York
- London
- Tokyo
- Paris
- Amsterdam
- Shanghai
- Moscow



Smoothing



<http://code.shutterstock.com/rickshaw/examples/extensions.html>

# The TimeViz Browser

A Visual Survey of Visualization Techniques for Time-Oriented Data

# of Techniques: 110

Search:

**Data**

Frame of Reference

- Abstract  ON
- Spatial  ON

Number of Variables

- Univariate  ON
- Multivariate  ON

**Time**

Arrangement

- Linear  ON
- Cyclic  ON

Time Primitives

- Instant  ON
- Interval  ON

**Visualization**

Mapping

- Static  ON
- Dynamic  ON

<http://survey.timeviz.net/>





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