

Visualization Tools

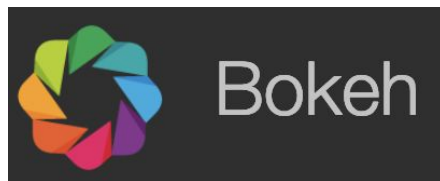
The Human Factor

Benjamin Bach

March 2019

Edinburgh University

bbach@inf.ed.ac.uk



Differing in

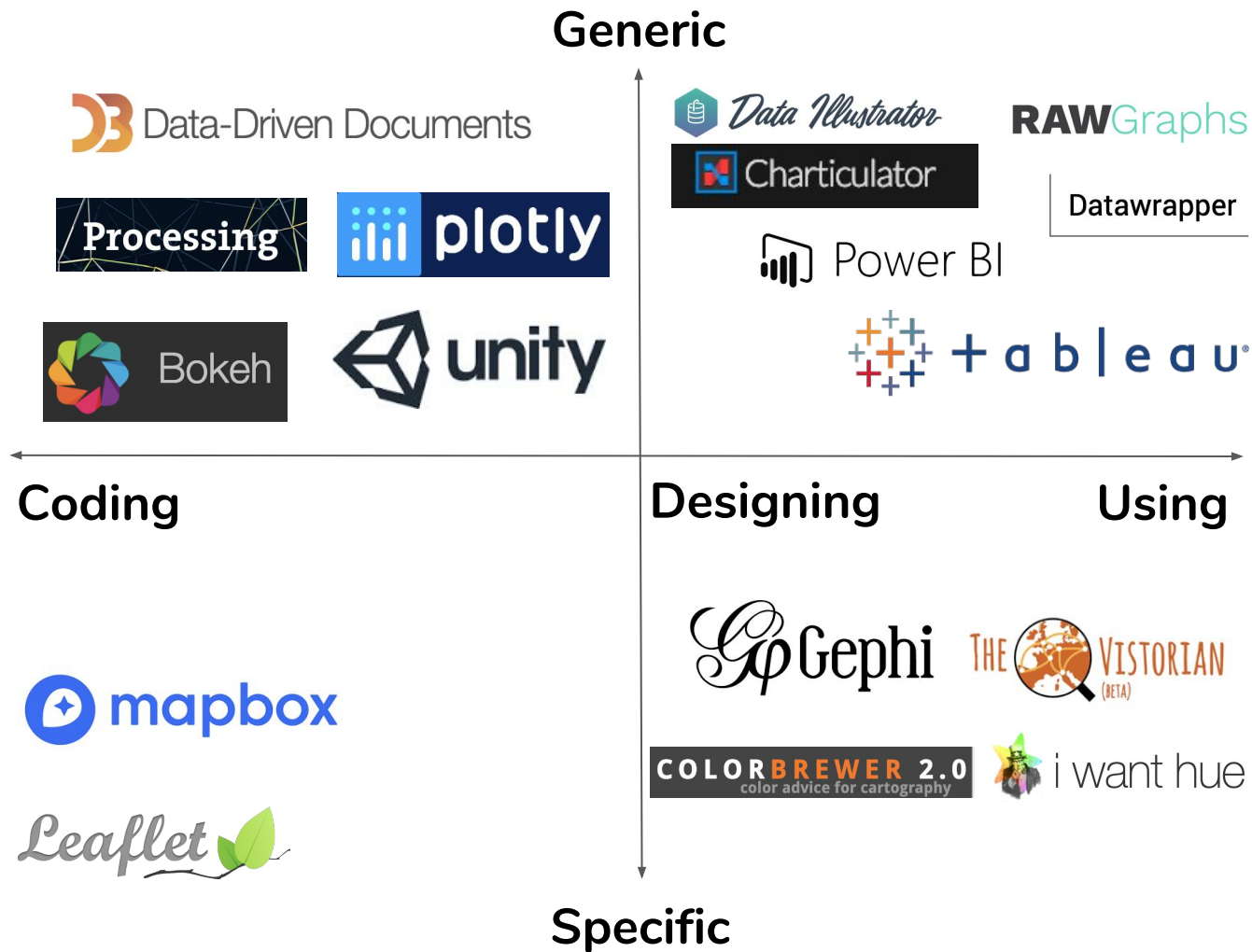
- Visualization
- Data sets
- Aesthetics
- Usability
- Accessibility
- Scalability
- Integration into workflows
- ...

Overview

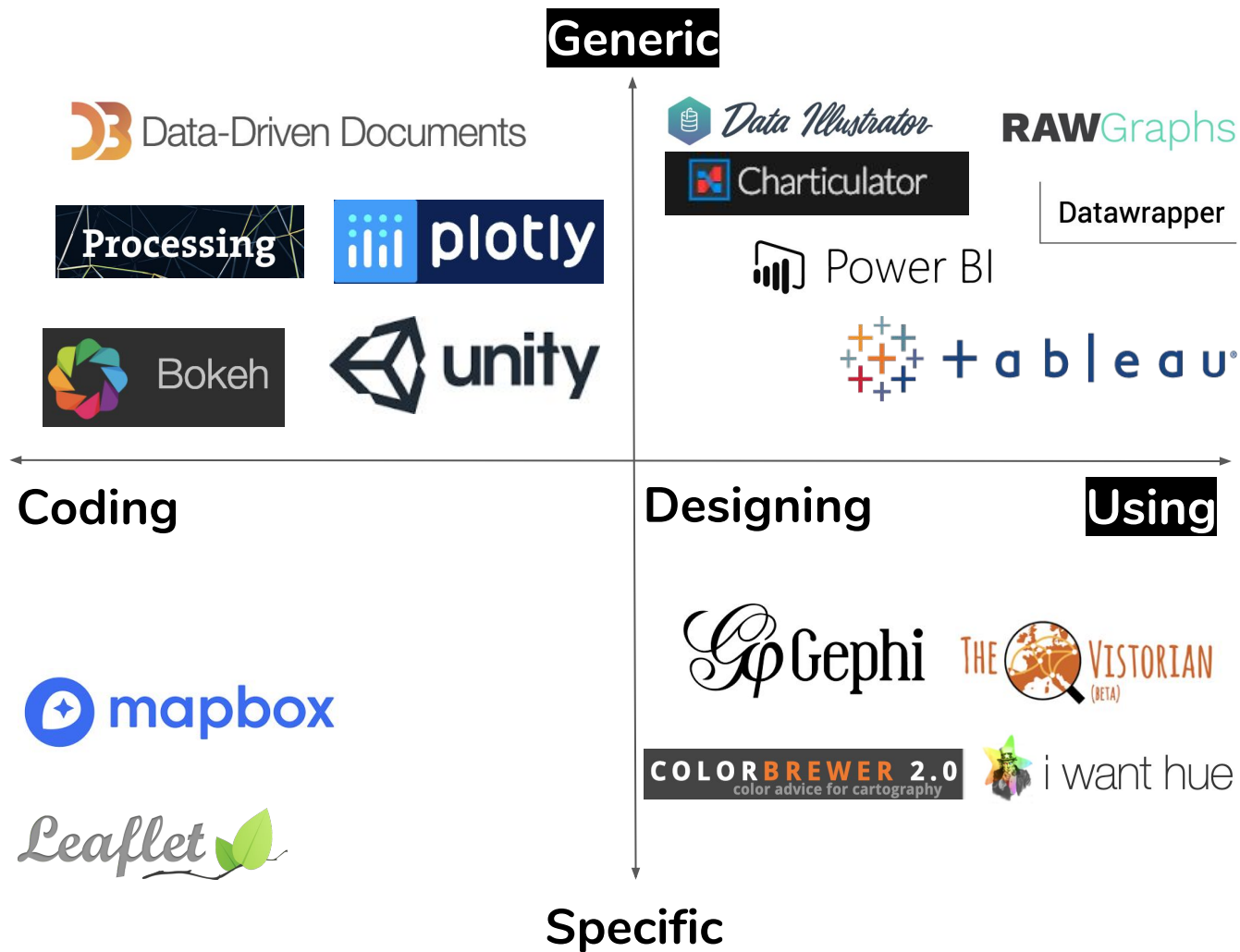
Variety

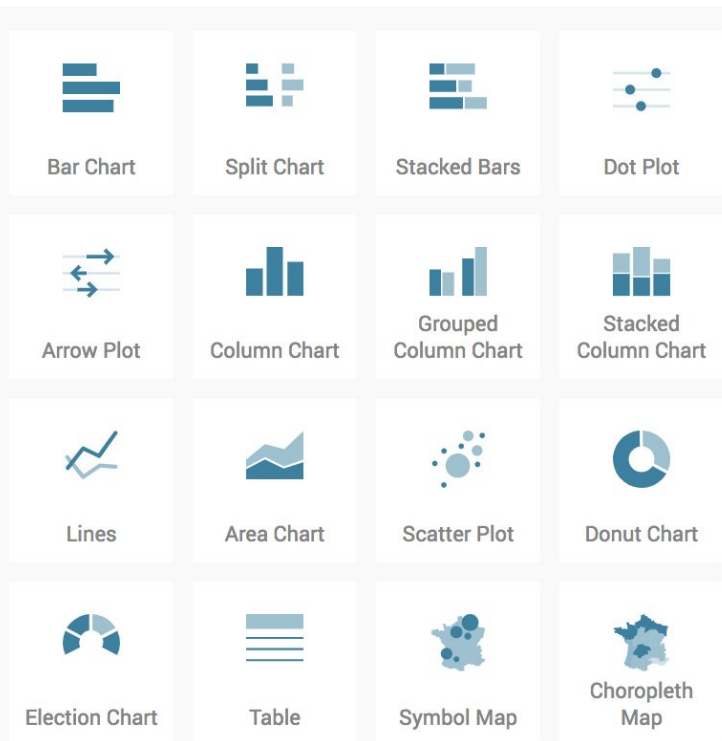
Workflows

Toolspace



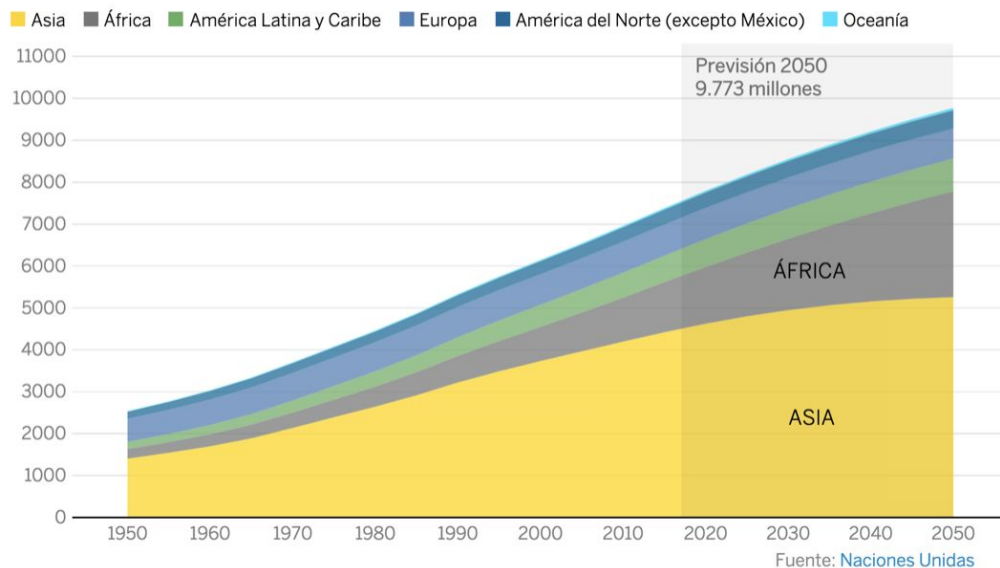
Toolspace





Evolución de la población mundial

En millones de habitantes



Enrich your stories with charts, in seconds.

 **CREATE A CHART**

 **CREATE A MAP**

or Create an Account / Login

– Faktum er at det er store forskjeller i kriminalitet mellem innvandrere, og spesielt etterkommerne, enn for personer med dansk opprinnelse, sier fullmektig Jens Bjerre i Dansk statistikk.

• **LES OGSÅ: Sylvi Listhaug bestilte selv rapporten SSB ikke ville lage for Frp**

Gemiddelde huizenprijs



De prijsstijging in de eerste jaarheft is in elk geval opmerkelijk. De vastgoedprijzen gaan sinds 2010 in stijgende lijn, maar wel geleidelijker. 'Dergelijke prijsstijging bij woonhuizen hebben we de jongste tien jaar nog niet gezien', bevestigt men bij de FOD Economie. En niet alleen klassieke woonhuizen werden flink duurder, ook villa's (+5,3 procent) en in mindere mate appartementen (+1,7 procent). 'Bij deze categorieën hebben we de jongste jaren wel sterke prijsstijgingen gezien, maar voor villa's is het toch weer een grote sprong', geleiden van 2016, zegt de FOD Economie. Een verklaring heeft men niet.

Evolutie vastgoedprijzen

Evolutie vastgoedprijzen in België, eerste semester van een bepaald jaar.



Source: FOD Economie - Created with Datawrapper

Gemiddeld kost een woonhuis in België nu 220.920 euro, een villa 362.829 en een appartement 225.171 euro. In Vlaanderen bleef de gemiddelde prijsstijging in de eerste zes maanden beperkt tot 4,2 procent voor een woonhuis en 3,8 procent voor een villa, tot respectievelijk 233.382 euro

was a snowstorm in the Northeast and Midwest during the week that the BLS does its survey, which kept some workers at home. Additionally, the “retail apocalypse” of announced store closings meant that more jobs than normal left the economy during the month. This month, the disappointing March number was revised down from 98,000 to 79,000. But the April jobs report provides a bounce back in part because of warmer weather and fewer layoffs. The Labor Department reported gains in hospitality, mining, healthcare, and finance. Including the revisions for the February and March reports, an average of 174,000 jobs were added per month over the last three months.

Monthly Changes in U.S. Employment (Non-Farm), 2006-2017



Source: Bureau of Labor Statistics | Get The Data | Embed

The Atlantic

3. An interest-rate hike in June now looks more likely.

In the past, the Fed has indicated that sustained growth in the U.S. labor market is one of the factors it considers when deciding interest rates. The strong April jobs

1 Upload Data ✓

2 Check & Describe ✓

3 Visualize

4 Publish & Embed

Chart type: Refine Annotate Design

Donut slices

- Slice color 
- Outer radius 58 %
- Inner radius 54 %
- Minimum grid column width 120
- Sort by
☒ Largest first
☐ Smallest first
☐ Keep order

Show order is determined by the first donut.

Labels

For help on custom labels, visit the [number & documentation](#)Number format: 4☐ Convert values to percentages☒ Show inside values☐ Show value inside donut

Gender Pay Gap

Median earnings of full-time workers in constant US Dollars, 2006

☒ Doctorate ☒ Master's degree ☒ Bachelor's degree ☒ Associate degree ☒ Other

Men



Women

Source: US Census, 2006 - Get the data - created with Tableau

Worksheet: Sheet1

100,000,000,000,000,000

6000

4

200

2

0

Reset

Reset

Reset

Reset

Reset

Triangle is a form of blue-yellow blindness. Less than 1% affected.



	Basic free	Single 29€/month	Team 99€/month	Custom 499€/month	Enterprise Contact us
User type	Just want to try	Use daily	Professional use in a team	Full solution with custom branding	

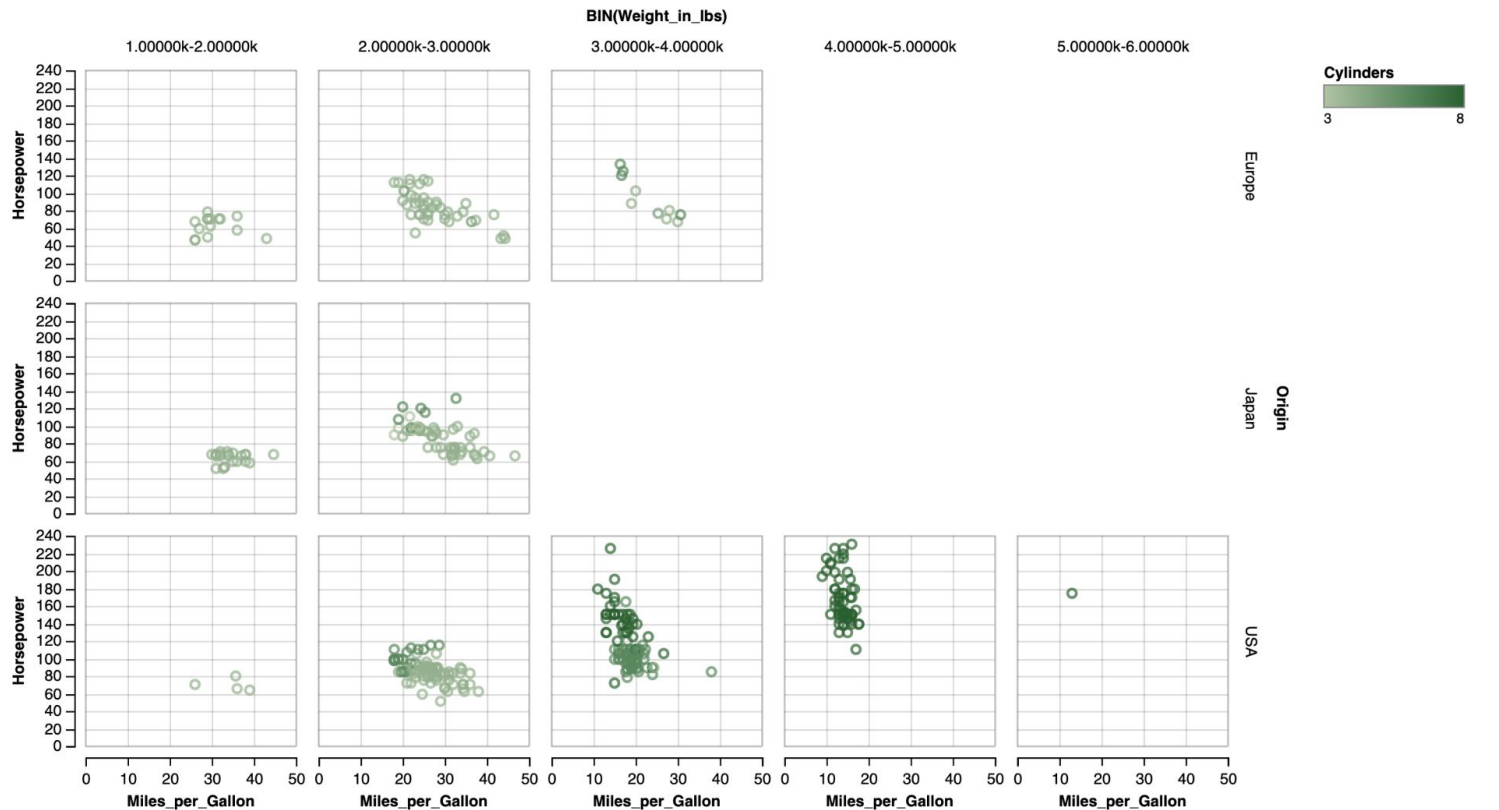
PoleStar / Vega

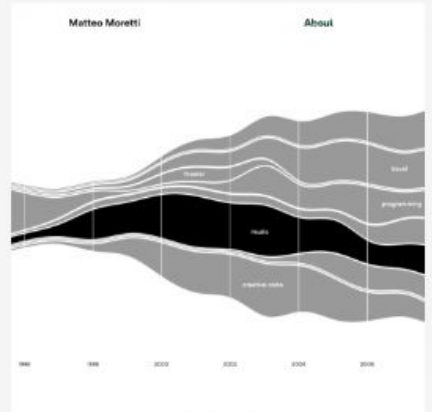
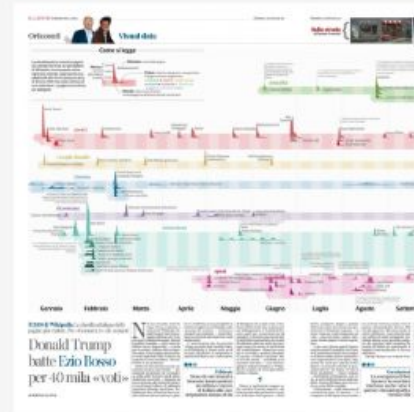
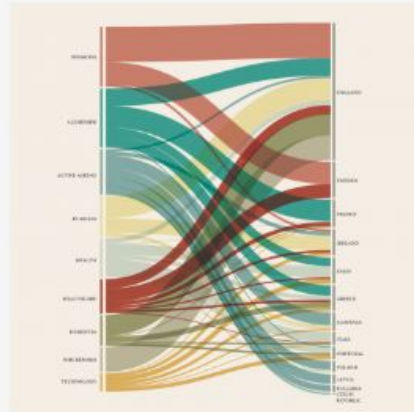
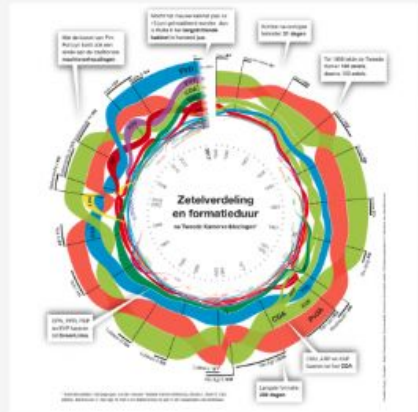
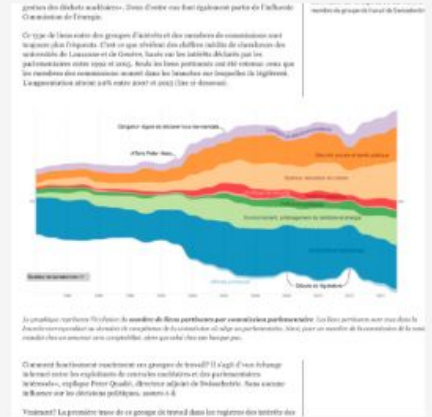
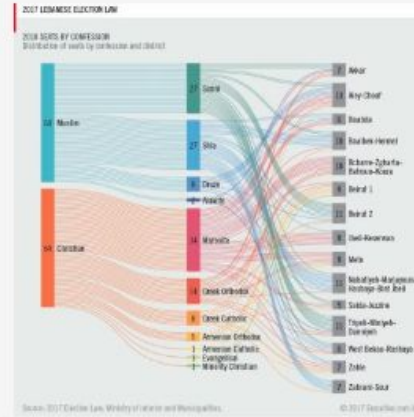
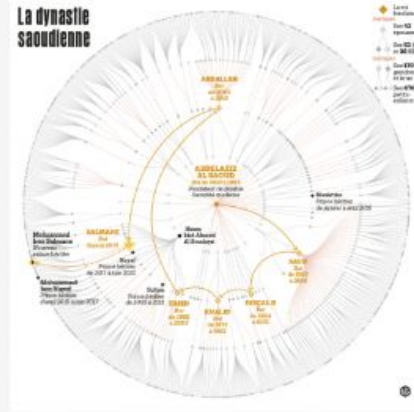
<https://vega.github.io/polestar>



PoleStar / Vega

<https://vega.github.io/polestar>





Map your Dimensions

8

Media wing



New year



Market Share number



Group



Drag numbers, strings, dates here

Media wing



Date



Drag numbers, dates, strings here

New year



Size

Drag numbers here

Customize your Visualization

width



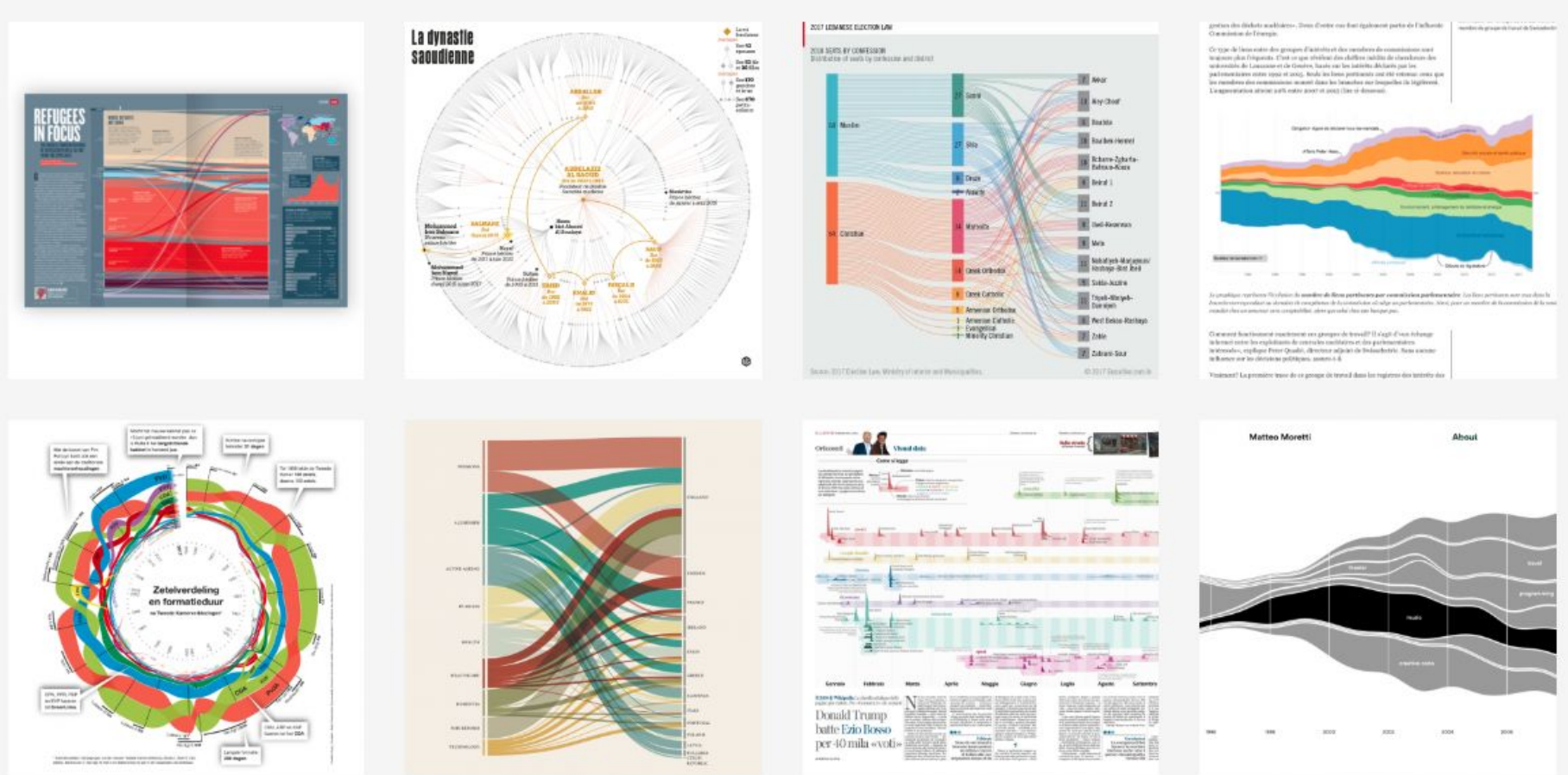
600

height

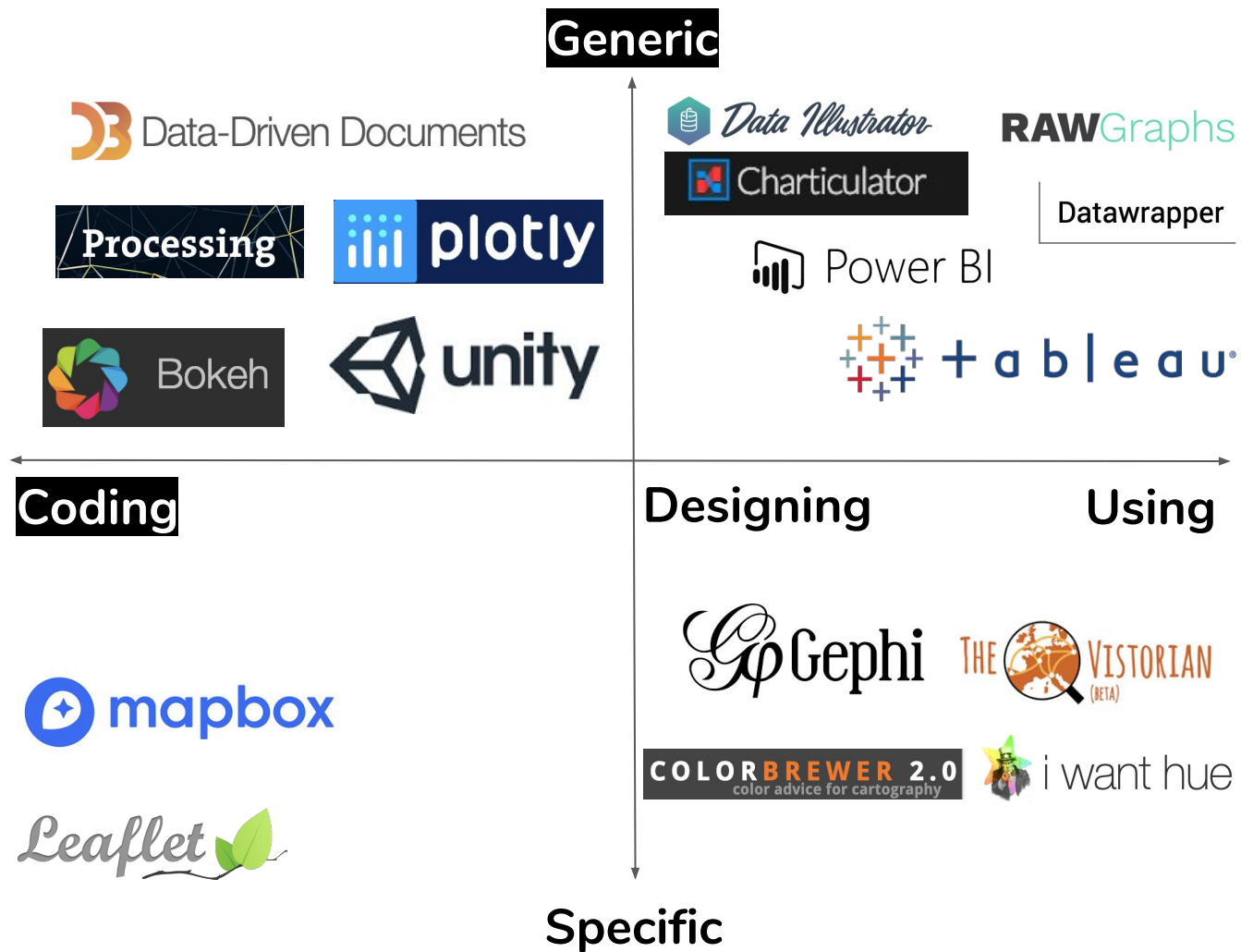
600

Feeling





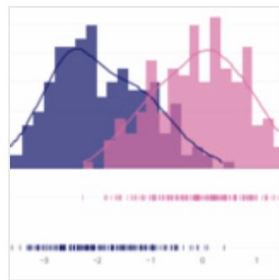
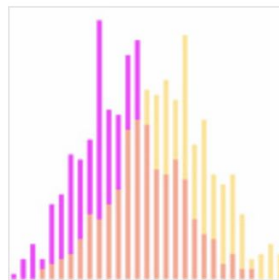
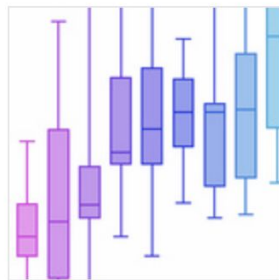
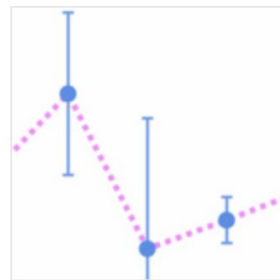
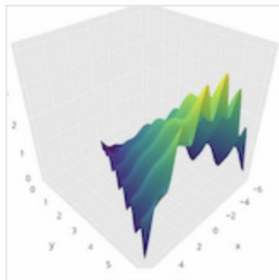
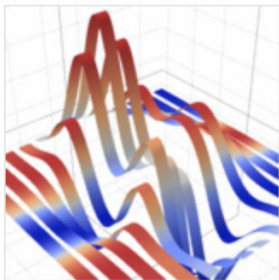
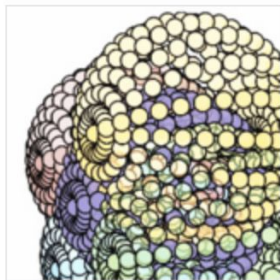
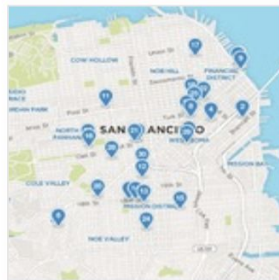
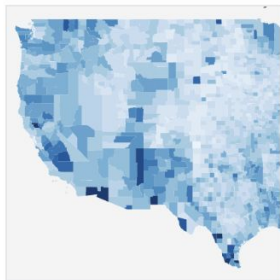
Toolspace



Python: Bokeh



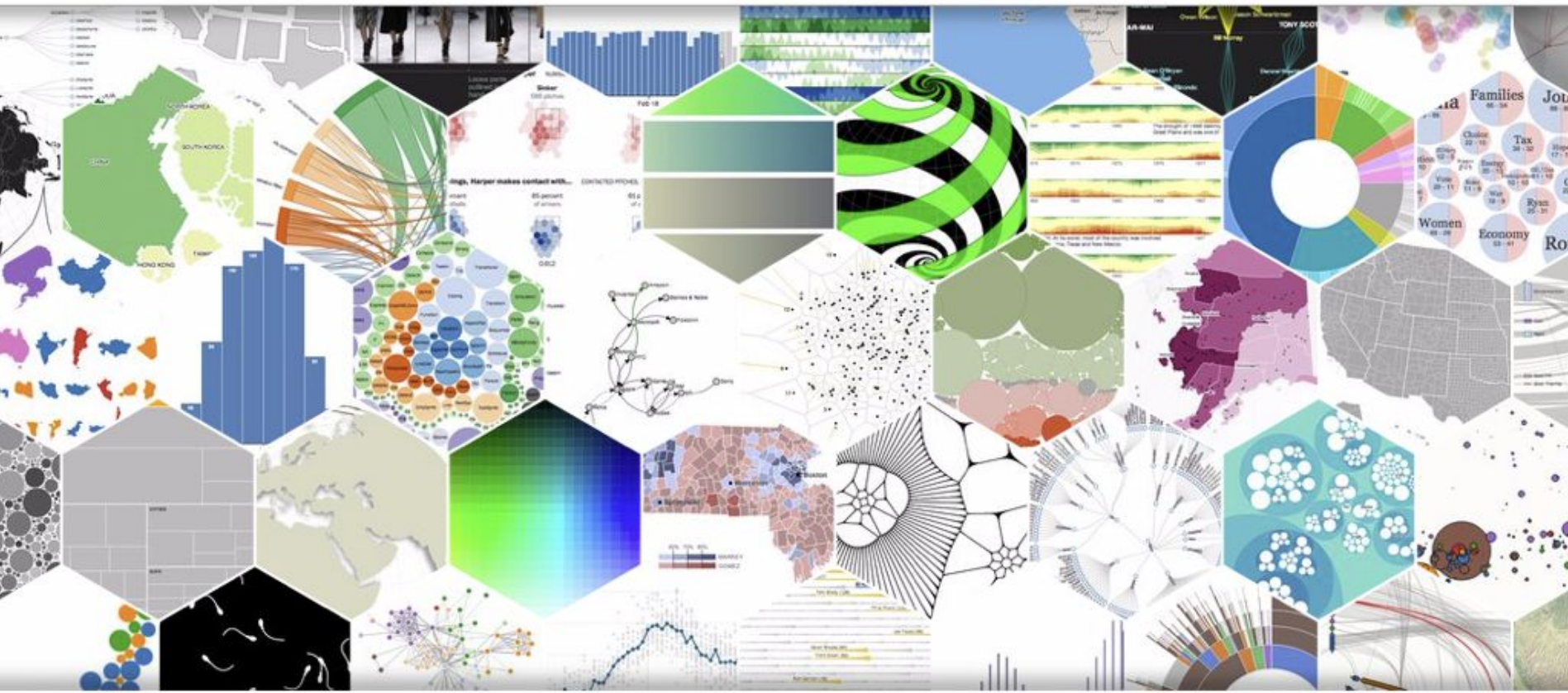
Plotly (Python, R, MatLab, Perl, REST,) > JavaScript





Data-Driven Documents

<http://d3.js>

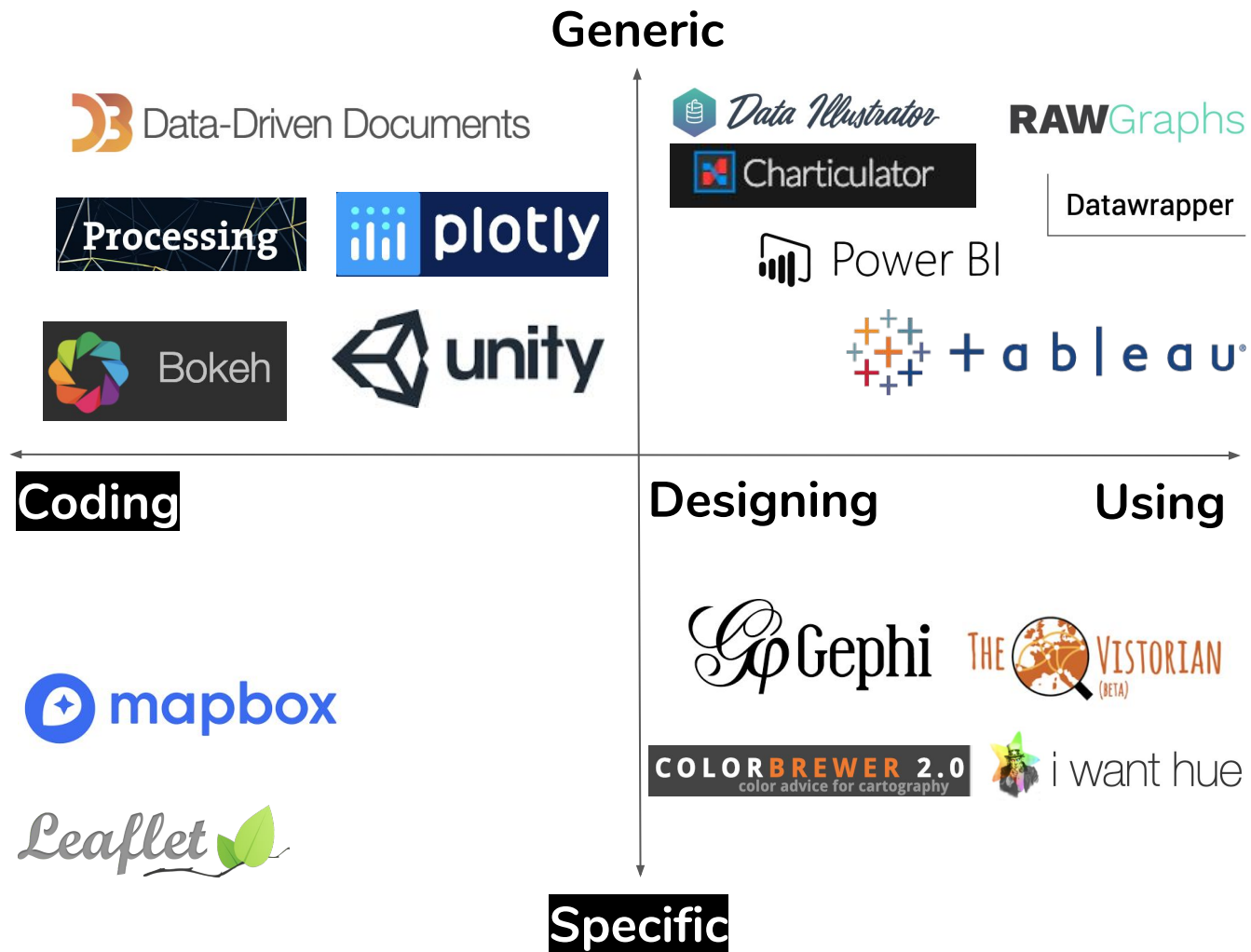


Data-Driven-Documents (D3)

<http://d3.js>

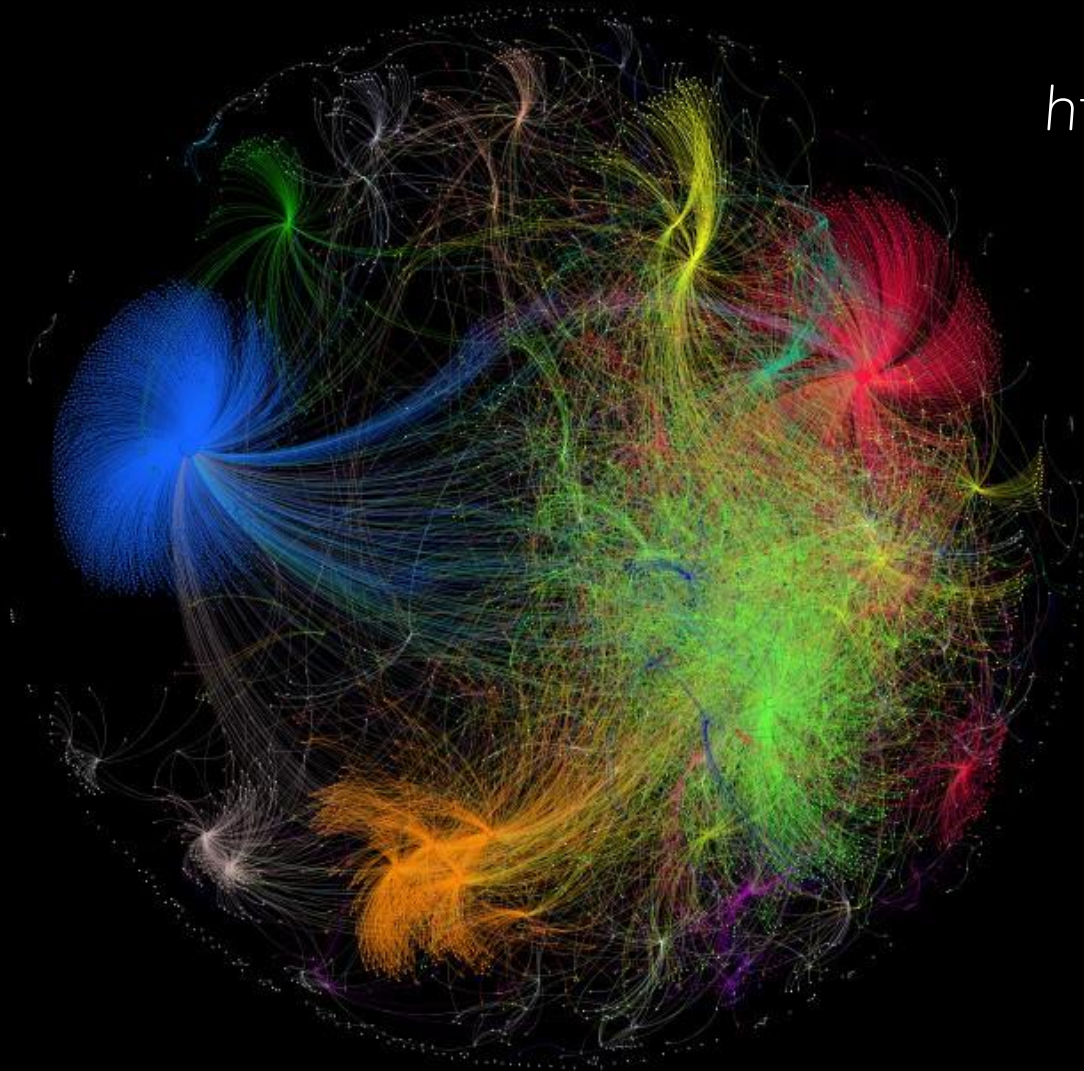
- Importing (CSV, Json, etc..)
 - Objects (shapes) and visual attributes
 - JQuery
 - Convenience functions
 - Tons of examples and huge community
-
- Tricky to learn (start now)
 - Tons of libraries and tutorials
 - Powerful and nice

Toolspace

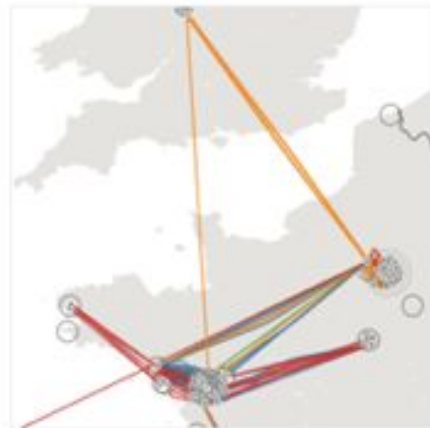
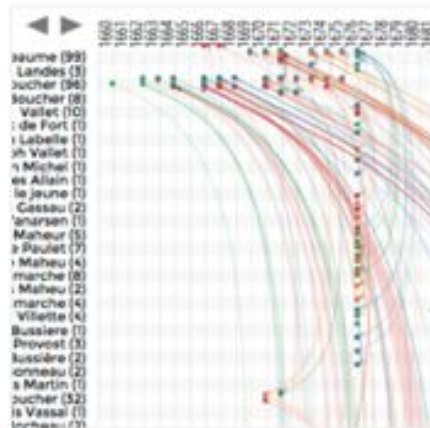


Gephi

<https://gephi.org>



Interactive Visualizations for Dynamic and Multivariate Networks.
Free, online, and open source.



Networks 123

Network 100460201000 ▼

Data Tables 123

[Relationships table](#)
[Nodes table](#)

Nodes table

Network

Name: Network 100460201000

View the visualization. Load a visualization from the network for help.

Node Table

A node table describes the nodes in the network. That means that each row in the node table describes a node and its relations, or attributes.

Select a previously uploaded node table from the list:

Link Table

A link table describes the links in a network. That means that each row describes a link with at least a source and target. Optional attributes include time, link type, link weight, and locations of source and target nodes while connected through this link.

Select a previously uploaded link table from the list:

Table shows that 207 rows out of 480 rows in total.

Show 10 entries

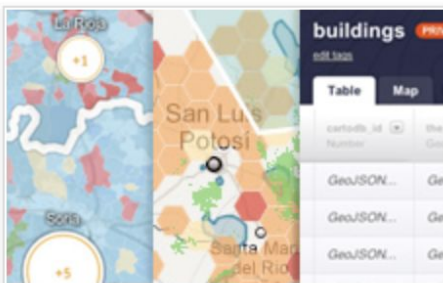
	Index	Name 1	Name 2	Content	Name 1	Name 2	Other props	Node Name	Cost \$/h	Index 1	Date
		Source Node	Target Node	Link Type	Source Node	Target Node	Weight	Link Type	Cost \$/h	Index 1	Date
0		Robert Anthoine	St Nicolas, Nantes	Commercial	Robert Anthoine	St Nicolas, Nantes		Commercial	400000	1000000	10/10/2019
1		Marc Bourcier	St Nicolas, Nantes	Commercial	Robert Anthoine	St Nicolas, Nantes		Commercial	400000	1000000	10/10/2019
2		Marc Bourcier	St Nicolas, Nantes	Family	Robert Anthoine	St Nicolas, Nantes		Commercial	400000	1000000	10/10/2019
3		Marc Bourcier	St Nicolas, Nantes	Family	Marc Bourcier	St Nicolas, Nantes		Commercial	400000	1000000	10/10/2019
4		Marc Bourcier	Paris	Commercial	Marc Bourcier	St Nicolas, Nantes		Commercial	400000	1000000	10/10/2019
5		Marc Bourcier	Paris	Commercial	Robert Anthoine	Paris		Commercial	400000	1000000	10/10/2019
6		Y. B. B.	St Nicolas, Nantes	Travel	Y. B. B.	St Nicolas, Nantes		Commercial	400000	1000000	10/10/2019
7		Y. B. B.	St Nicolas, Nantes	Commercial	Joseph L. B.	St Nicolas, Nantes		Commercial	400000	1000000	10/10/2019

Geographical



Leaflet

A lightweight JavaScript library for making tile-based interactive maps for desktop and mobile browsers.



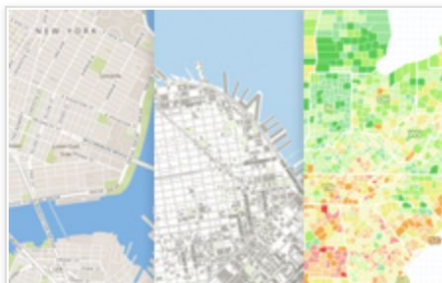
CartoDB

A web service for mapping, analyzing and building applications with data.



Polymaps

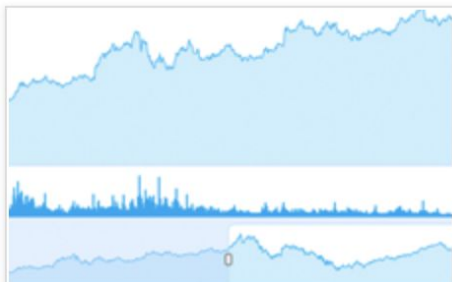
A library for making dynamic, interactive maps with image- and vector-based tiles.



MapBox

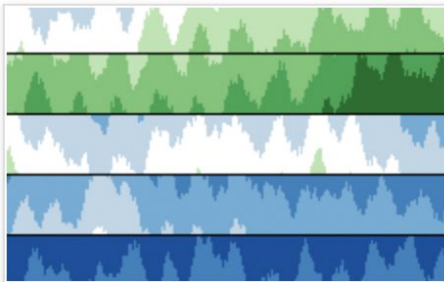
A web platform for hosting custom designed map tiles and a set of open source tools to produce them.

Temporal



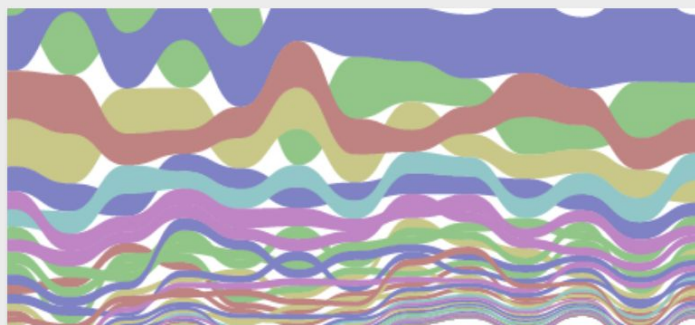
Envision.js

A library for creating fast, dynamic and interactive time series visualizations.



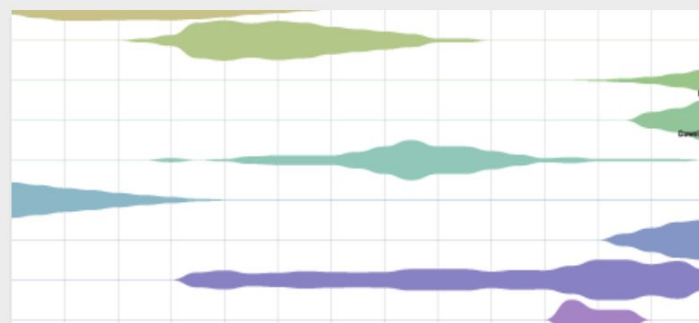
Cubism.js

A library for creating interactive time series and horizon graphs based on D3.js



Bump Chart

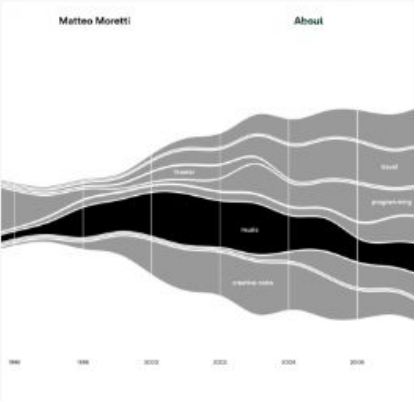
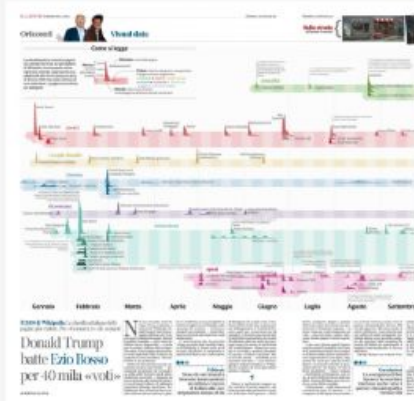
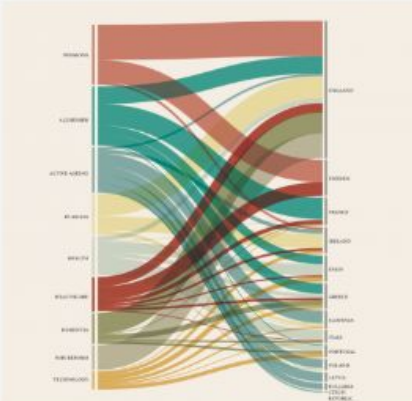
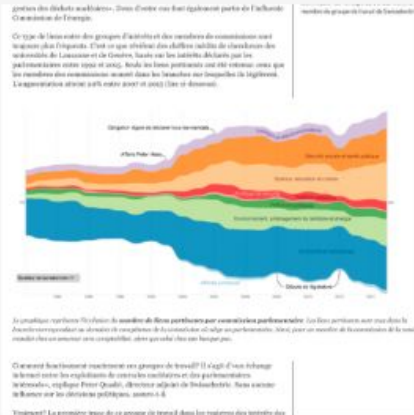
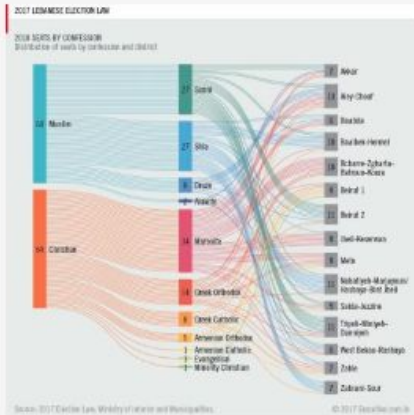
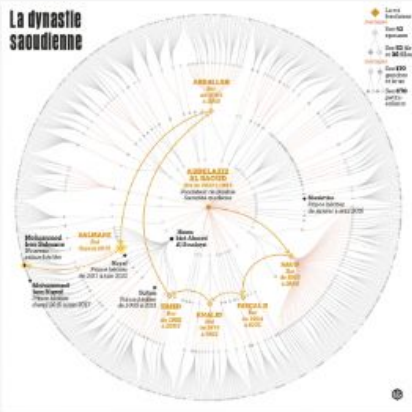
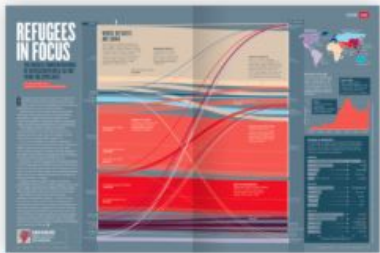
Time series

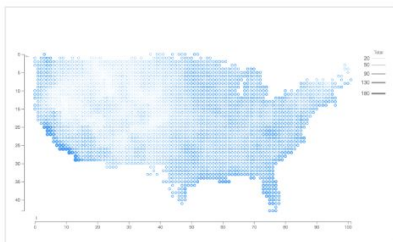


Area graph

Time series

Presentation & Infographics

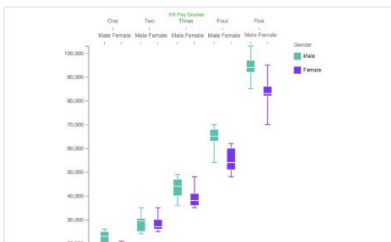




The Pleasant Places to Live

Binned map showing pleasant weather days in the US.

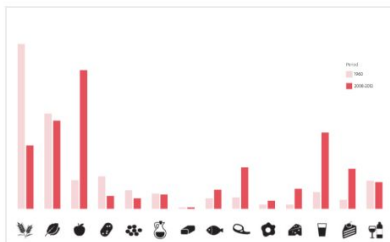
[Open Example](#) | [Watch Demo](#)



Gender Pay Gap - Box Plot

A box and whisker plot demonstrating the gender pay gap across salary grades.

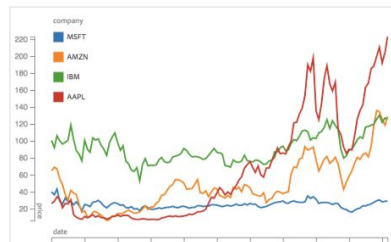
[Open Example](#) | [Watch Demo](#)



How Consumption Has Changed

How consumption of different types of food has changed since 1960

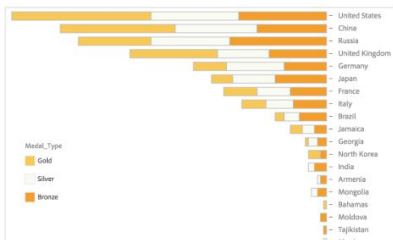
[Open Example](#) | [Watch Demo](#)



Stock Market

Monthly stock prices for four companies from 2000 to 2010

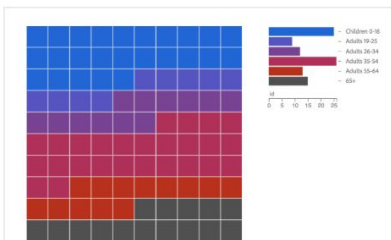
[Open Example](#) | [Watch Demo](#)



2012 Summer Olympic Medals

Stacked bar chart on the number of gold, silver and bronze medals by country

[Open Example](#) | [Watch Demo](#)



Population Distribution by Age

The distribution of population by age groups in the United States in 2016

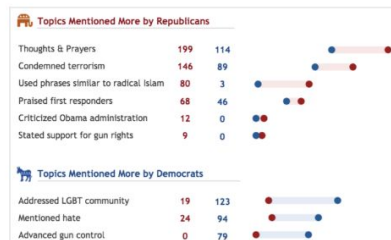
[Open Example](#) | [Watch Demo](#)



Share of Women across Job Levels

The proportion of women declines in higher job titles.

[Open Example](#) | [Watch Demo](#)

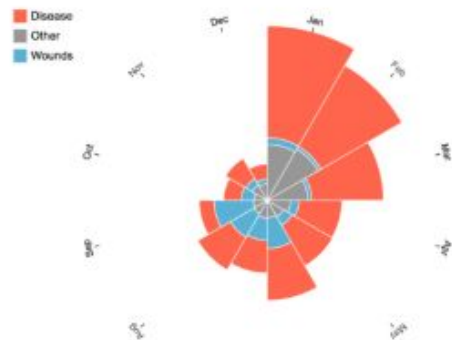


Partisan Reactions on Mass Shooting

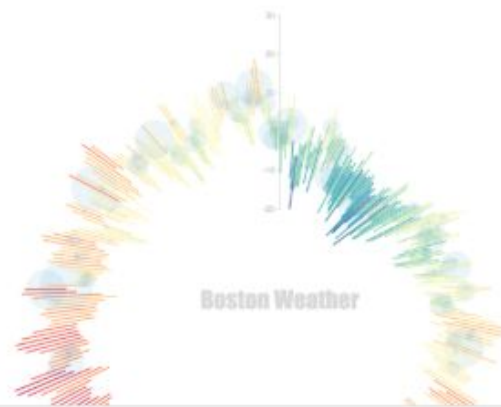
Topics mentioned by the two parties after the Orlando nightclub shooting

[Open Example](#) | [Watch Demo](#)

Diagram of the Causes of Mortality in the Army in the East



Causes of Mortality over time (Reproduction of the Nightingale chart)



Boston weather in a year

Fitbit Activity of 2016



Spiral Bar Chart

Coloring

Number of data classes: 9

[how to use](#) [updates](#) [downloads](#) [credits](#)

COLORBREWER 2.0

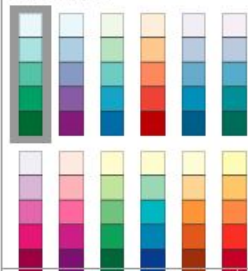
color advice for cartography

Nature of your data:

☒ sequential ☐ diverging ☐ qualitative

Pick a color scheme:

Multi-hue:



Single hue:



Only show:

- ☐ colorblind safe
- ☐ print friendly
- ☐ photocopy safe

Context:

- ☐ roads
- ☐ cities
- ☒ borders

Background:

- ☒ solid color
- ☐ terrain

color transparency

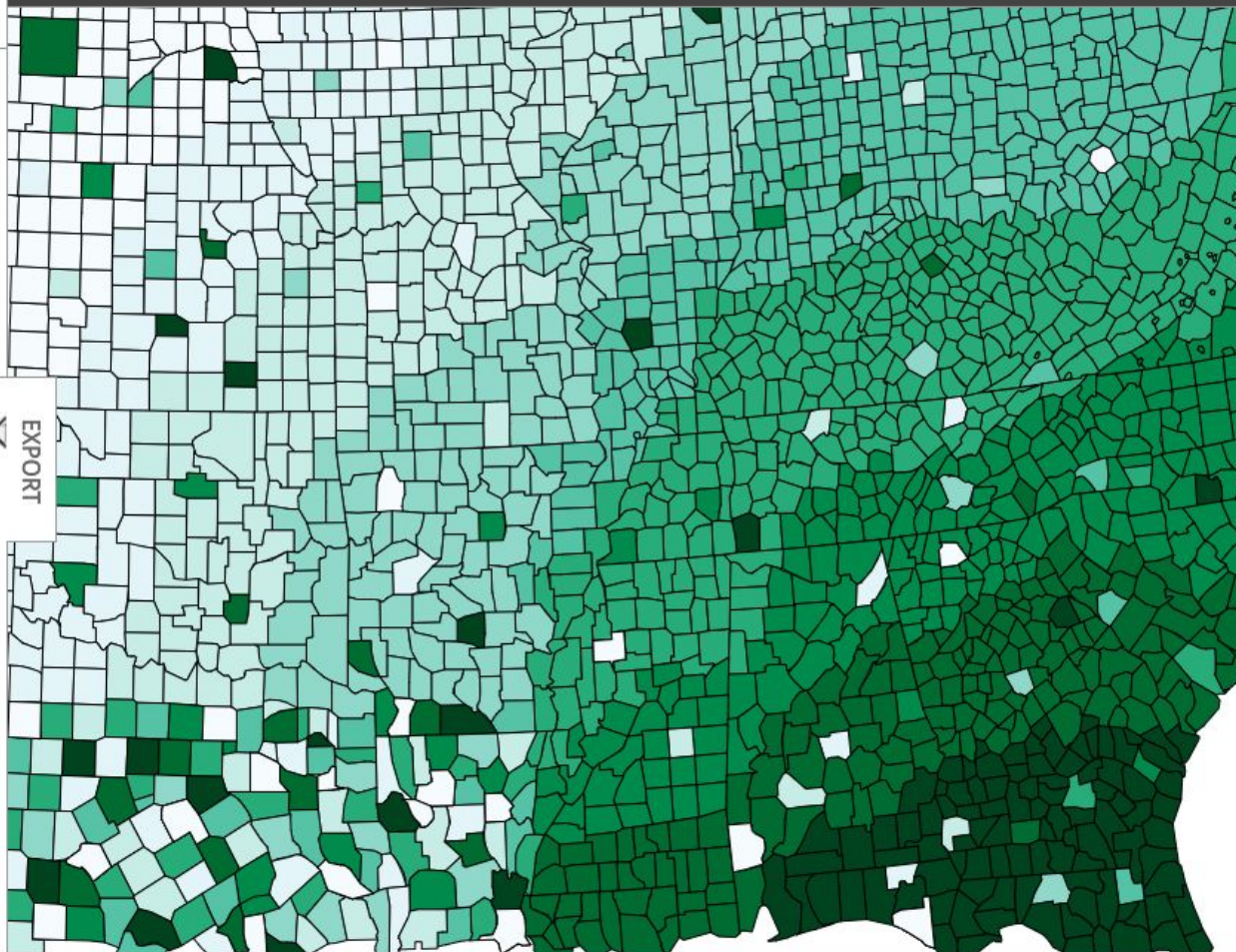
9-class BuGn



HEX

#f7fcfd
#e5f5f9
#ccece6
#99d8c9
#66c2a4
#41ae76
#238b45
#006d2c
#00441b

EXPORT

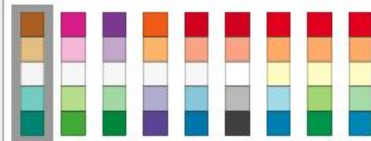


Number of data classes: 9 ▾

Nature of your data:

☐ sequential ☒ diverging ☐ qualitative

Pick a color scheme:



Only show:

- ☐ colorblind safe
- ☐ print friendly
- ☐ photocopy safe

Context:

- ☐ roads
- ☐ cities
- ☒ borders

Background:

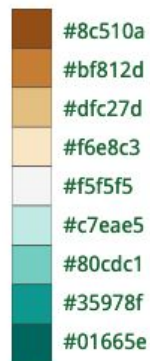
- ☒ solid color
- ☐ terrain

color transparency

9-class BrBG



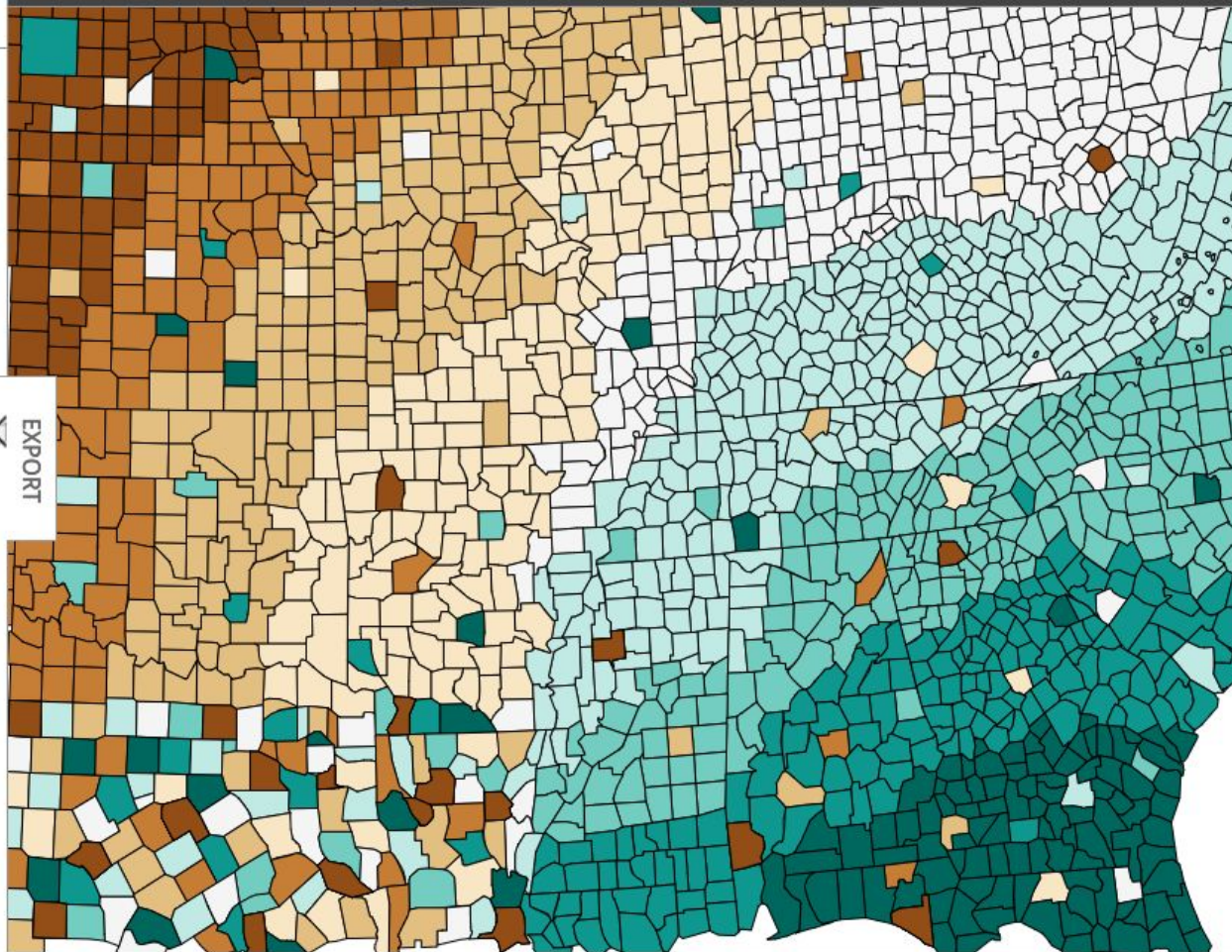
HEX ▾



EXPORT

how to use | updates | downloads | credits

COLORBREW 2.0
color advice for cartography

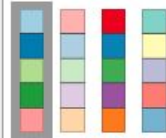


Number of data classes: 9 ▾

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Pick a color scheme:



Only show:

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☐ print friendly
☐ photocopy safe

Context:

- ☐ roads
☐ cities
☒ borders

Background:

- ☒ solid color
☐ terrain

color transparency

9-class Paired



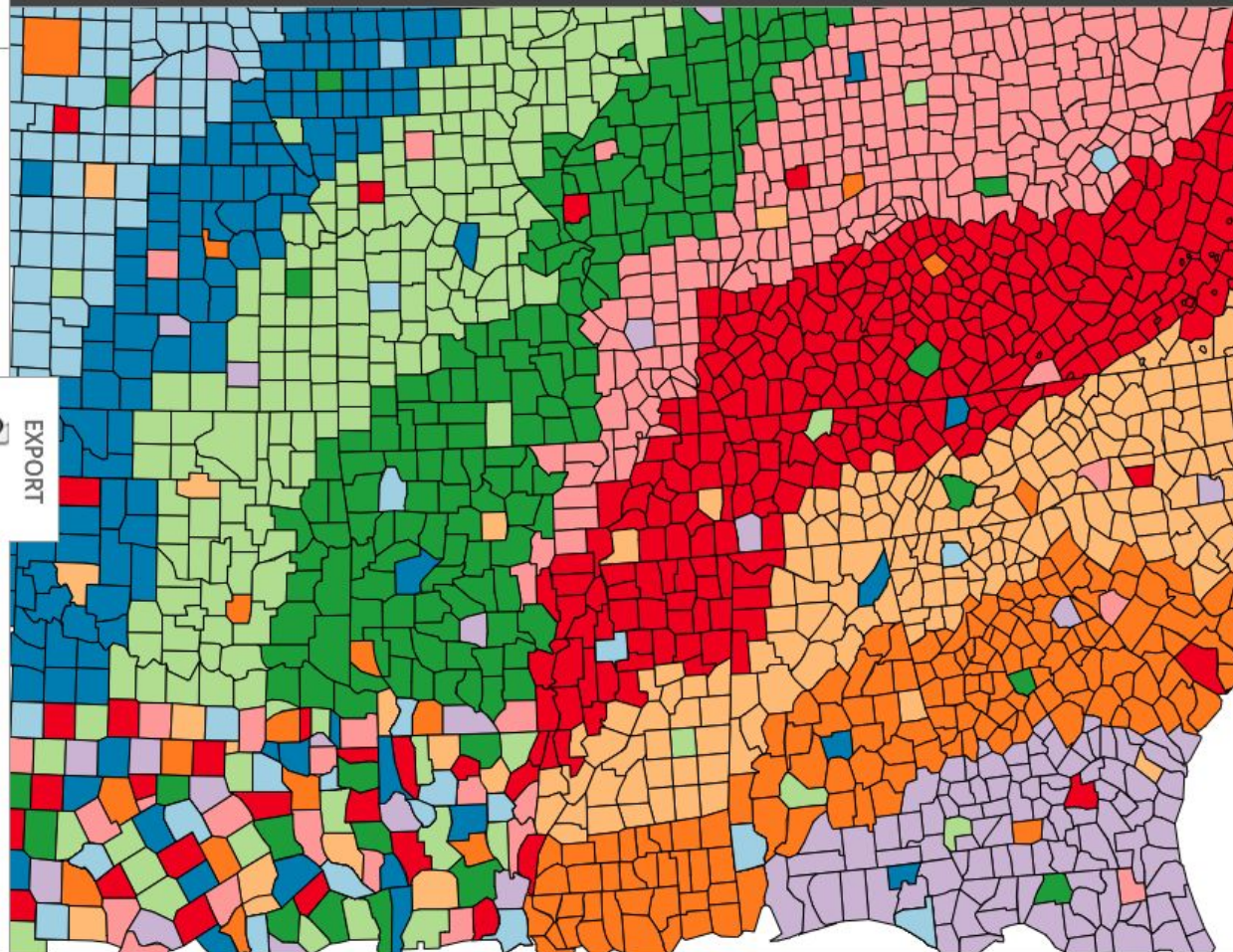
HEX ▾

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	#fdbf6f
	#ff7f00
	#cab2d6

EXPORT

how to use | updates | downloads | credits

COLORBREW 2.0
color advice for cartography





i want hue

Colors for data scientists.

Generate and refine palettes of
optimally distinct colors.

Color space

Default preset

H 0



360

C 30



80

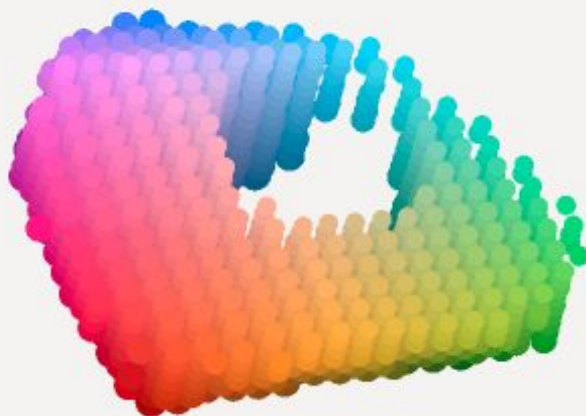
L 35



80

☐ Improve for the **colorblind** (slow)

☐ Dark background



Palette

5

color soft (k-Mean)

Make a palette



Color space

Pastel

H: 0

360

C: 0

30

L: 70

100

☐ Improve for the colorblind (slow)

☐ Dark background



Palette

5

colors

soft (3-Mean)

Reset palette



Start by: soft (3-Mean) | ordered | lightness | random

Fit to color space



Colors

#294248

41,66,64

HEX

RGB

JSON

HEX json

```
[ "#294248",  
  "#c6ccc2",  
  "#2f251b",  
  "#858a84",  
  "#555b4c" ]
```

RGB json

CSS

HEX list for CSS

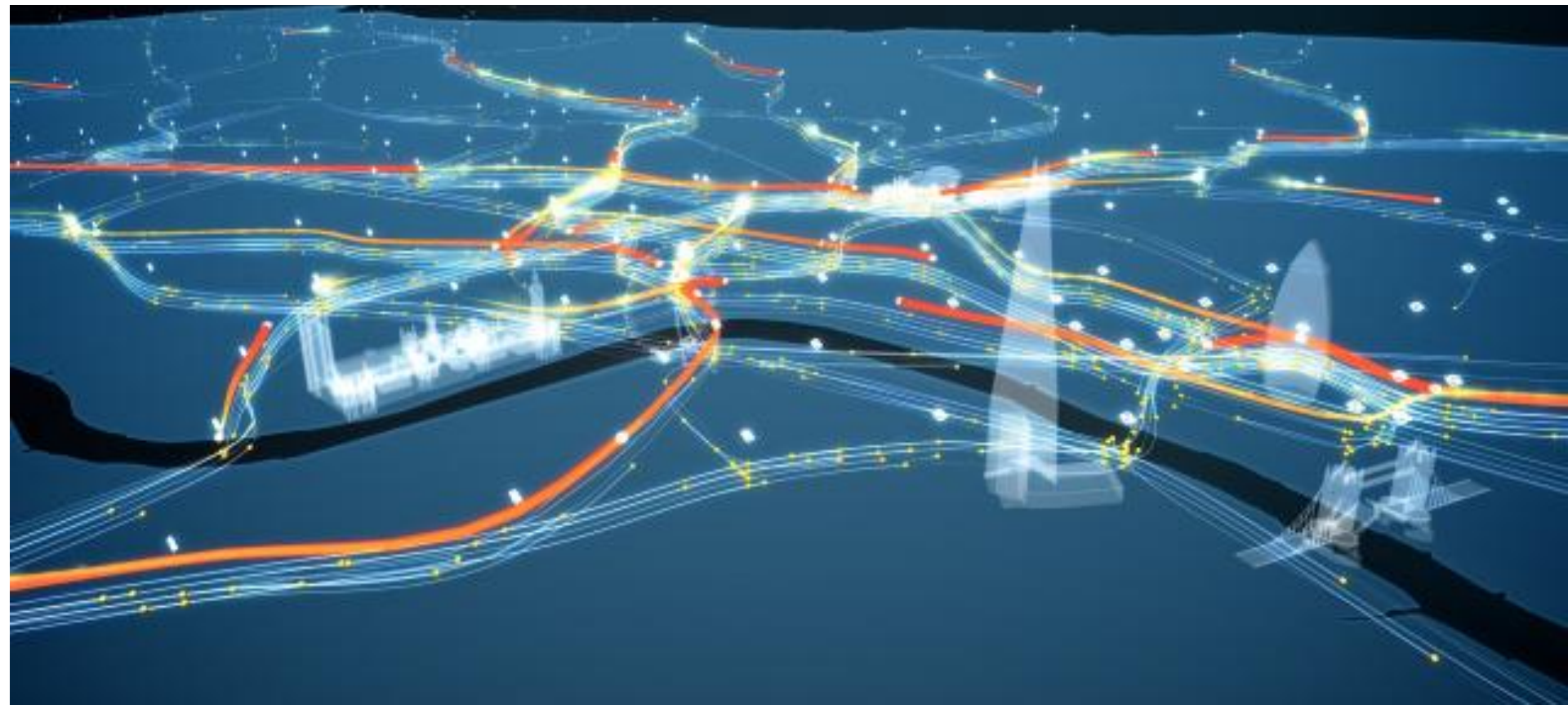
```
#294248  
#c6ccc2  
#2f251b  
#858a84  
#555b4c
```

RGB list for CSS

Immersive Environments



<https://unity3d.com>



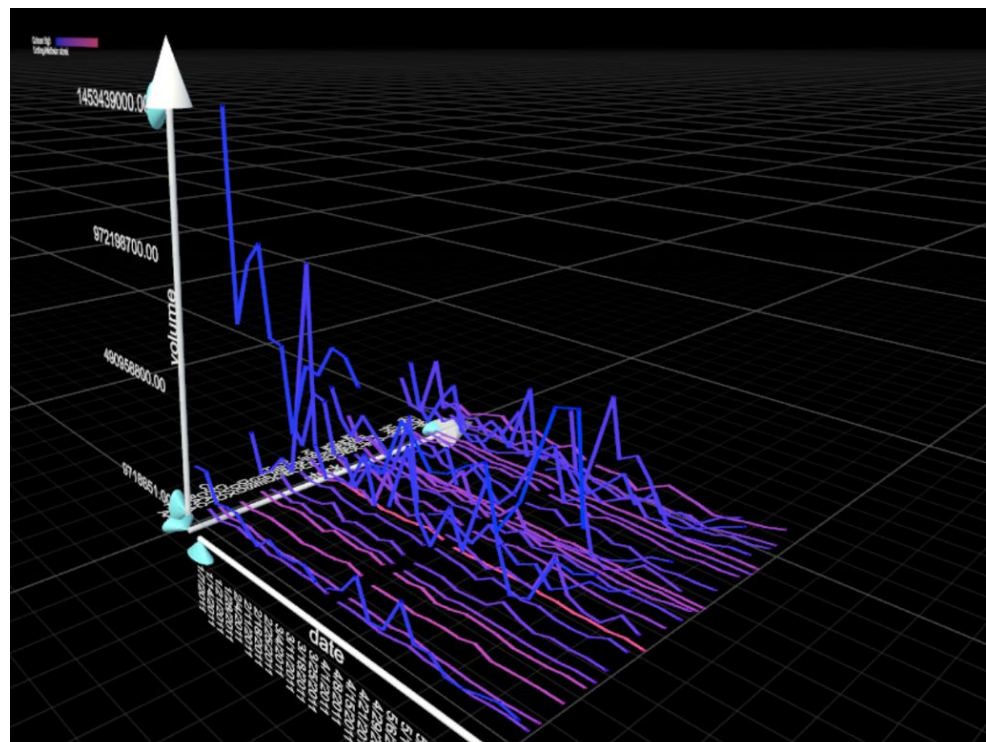
DXR

<https://sites.google.com/view/dxr-vis>

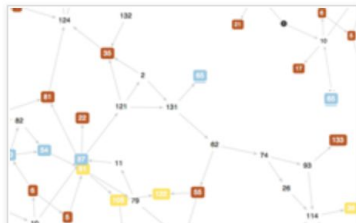


IATK

<https://github.com/MaximeCordeil/IATK>



More Tools!

[All](#)
[Maps](#)
[Charts](#)
[Data](#)
[Color](#)
<http://datavisualization.ch>


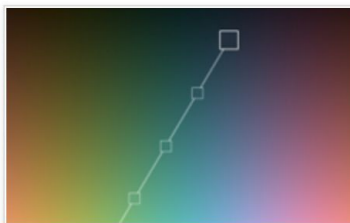
Arbor.js

A library of force-directed layout algorithms plus abstractions for graph organization and refresh handling.



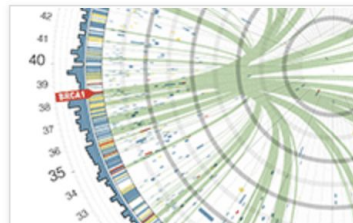
CartoDB

A web service for mapping, analyzing and building applications with data.



Chroma.js

Interactive color space explorer that allows to preview a set of linear interpolated equidistant colors.



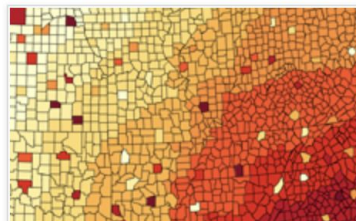
Circos

A software package for visualizing data in a circular layout.



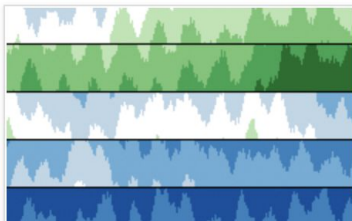
Cola.js

A library for arranging networks using constraint-based optimization techniques.



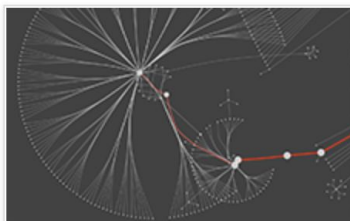
ColorBrewer

A web tool for selecting colors for maps.



Cubism.js

A library for creating interactive time series and horizon graphs based on D3.js



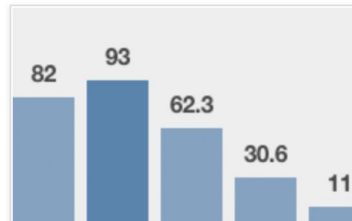
Cytoscape

An application for visualizing complex networks and integrating these with any type of attribute data.



D3.js

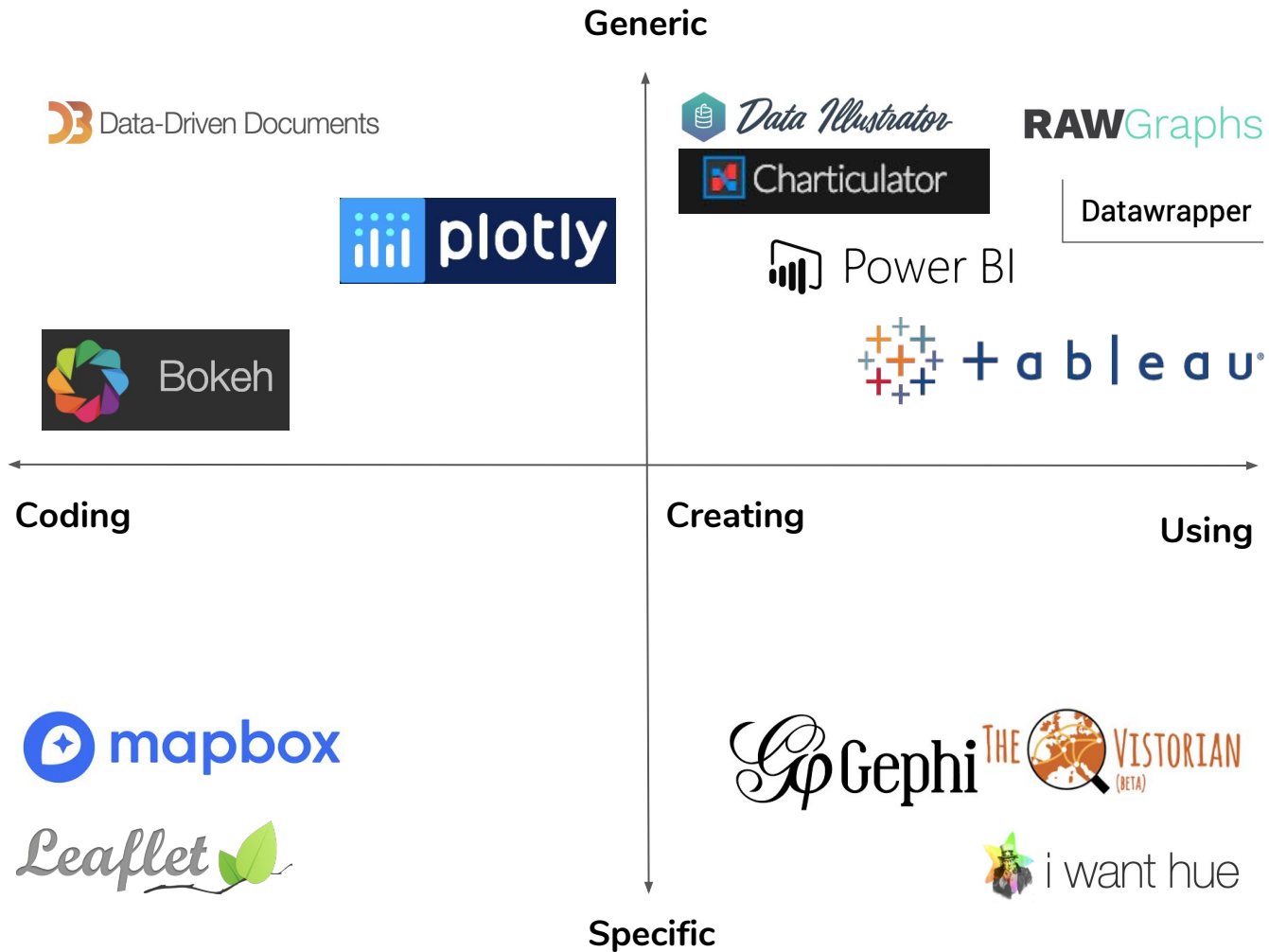
An small, flexible and efficient library to create and manipulate interactive documents based on data.



Dance.js

A simple data-driven visualization framework based on Data.js and Underscore.js

Tool Space



Tool Space

- Scalability
- Interaction
- Visualizations
- Availability
- Learning
- Aesthetics
- Integration
- ...

Blueprint



Plot Map



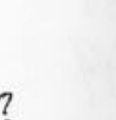
Worlds



Multisprint



Exploration



1) Rings | Race | Spiral | Exploration

2) Web | Pier | Submap | Dead Rings



4cd



polar coordinates



cc
latitude

cl
longitude

cl
longitude

cl
longitude

cl
longitude

cl
longitude

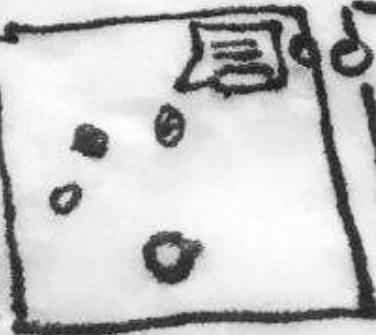
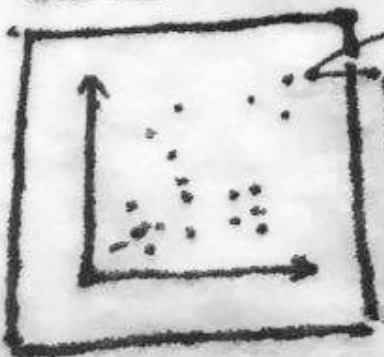
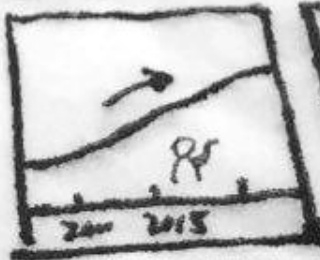
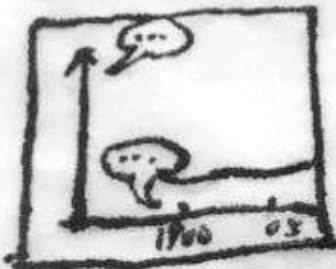


evenly spaced concentric circles

cells as an example

graticule

v7 Placement Coordinates

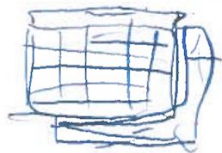


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[Unread \(1\)](#)
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[Categories](#)
[+ New Topic](#)

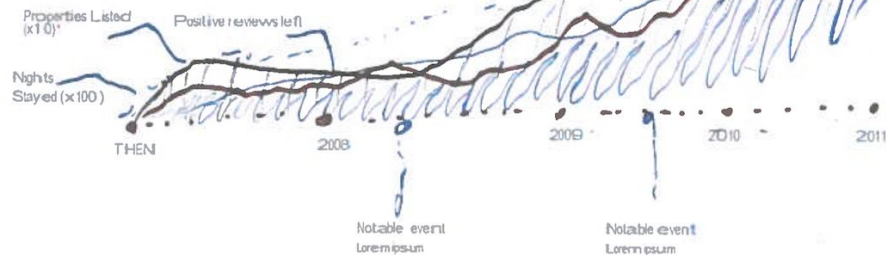
☰ Topic		Replies	Views	Activity
Distribution areas of dengue fever and its vector 1 ■ Visual Design	 	1	32	19h
Visualisation of Average and Median Dengue infection rates across countries ■ Visual Design	  	2	33	23h
Visualising Fatalities Rate of Measles in US across the years ■ Visual Design	  	2	114	23h
Visualising Disease Distribution Across the US ■ Pie Charts	 	1	36	2d
Visualising the evolution of Dengue in 5 countries ■ Visual Design	 	1	52	5d
Visualization Common contagion ■ Visual Design	 	1	46	5d
Visualizing Incidents of Meningitis and fatalities in the US (1920-1921) ■ Visual Design	 	1	32	5d

Tutorial

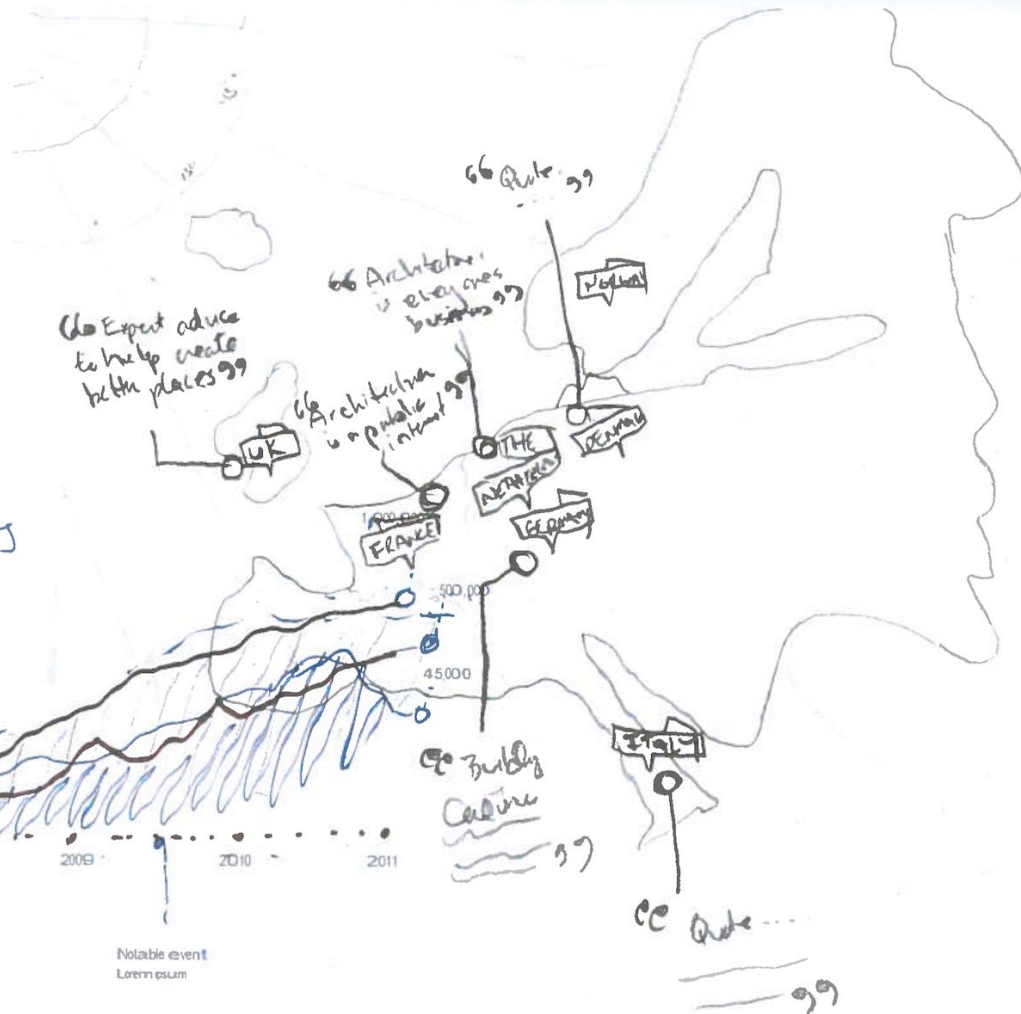
Longest consecutive reservation



91 nights

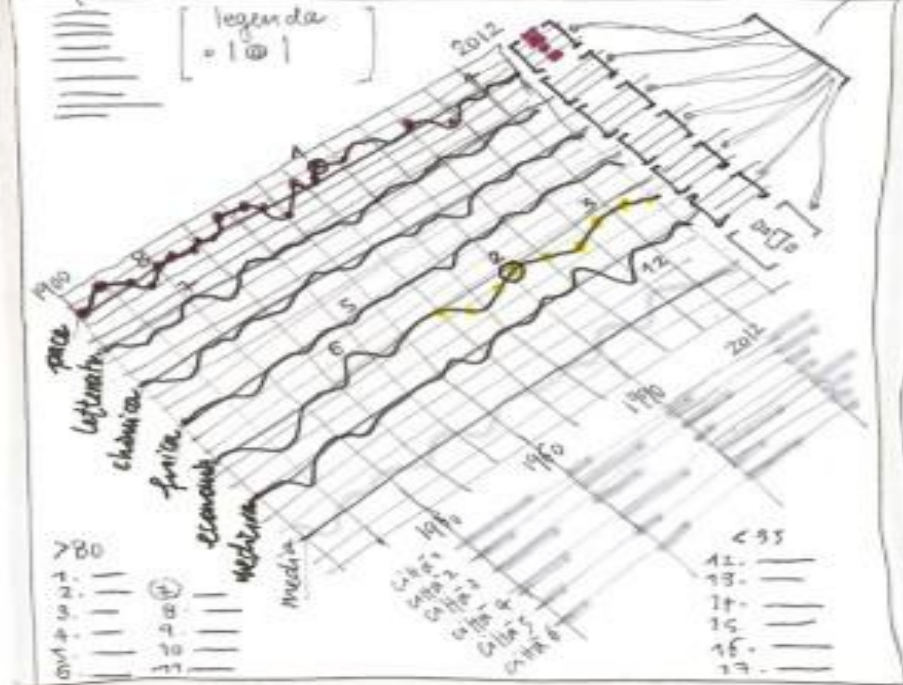


*Breakdown by color: entire apartments, private rooms, etc

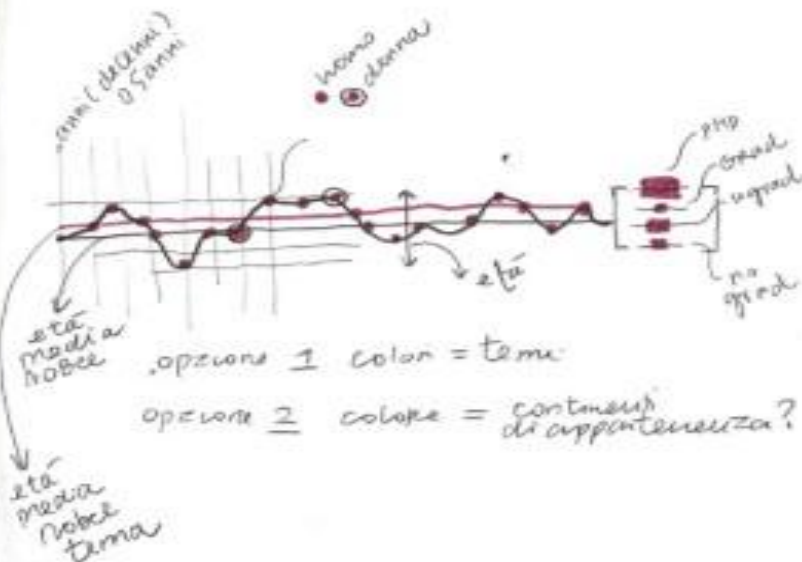


2000

Legenda
= 1 @ 1



Qualcosa che ora non so ancora 😊



options 1 color = term

opzione 2 colore = continuo di appartenenza?

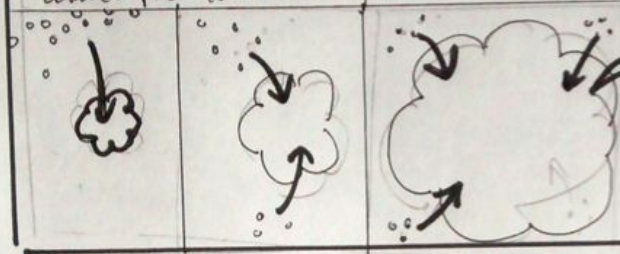
Esplorazione
dei nomi dei
"pnt giovani" o
"pnt vecchi"

- — di membro del pallino per ora tutto normale, cosa si potrebbe aggiungere? o altri premi vinti?

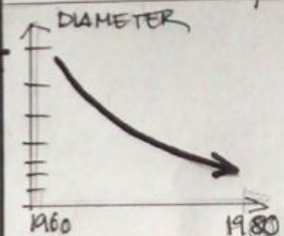
SLOVENE CAL. II

41

As this happens, the network grows by attracting new members joining the scientific community...



... and the diameter drops constantly

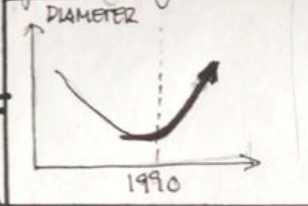


This trend continues, until, as the collapse of Y in 1990, when

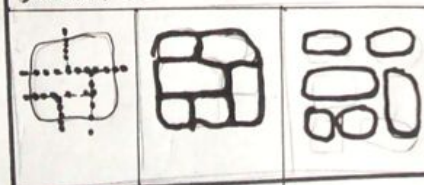
that year, the network loses many members



and its diameter grows again



The largest cluster falls into smaller clusters...



As whole remains only loosely connected

