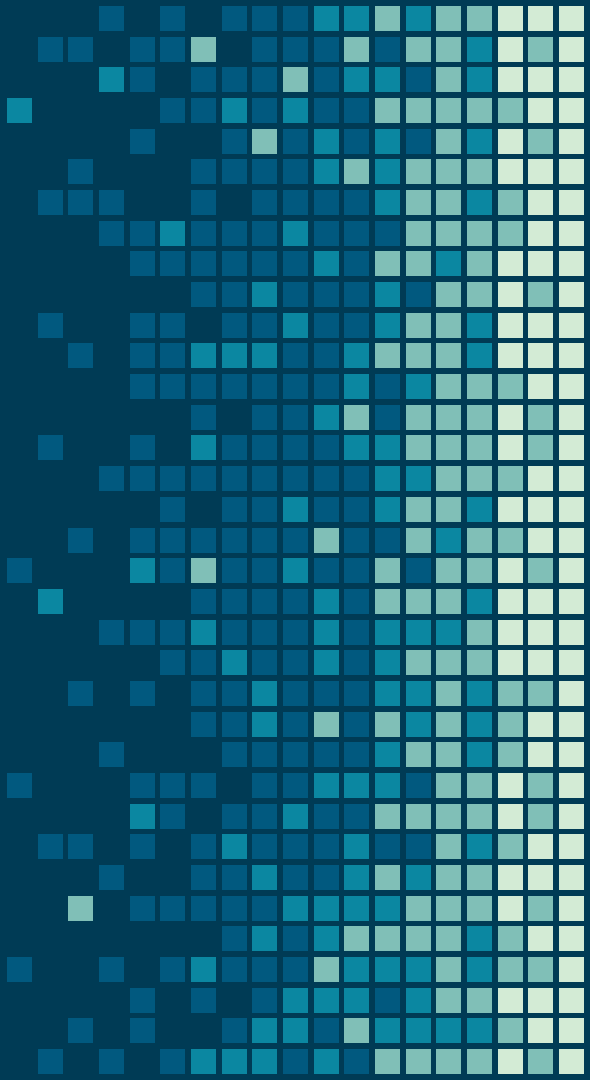
Data Visualisation in JS

Steve Purves
Euclidity



Who

Engineer

- Software Development
- Scientific Apps
- Data Science
- Machine Learning

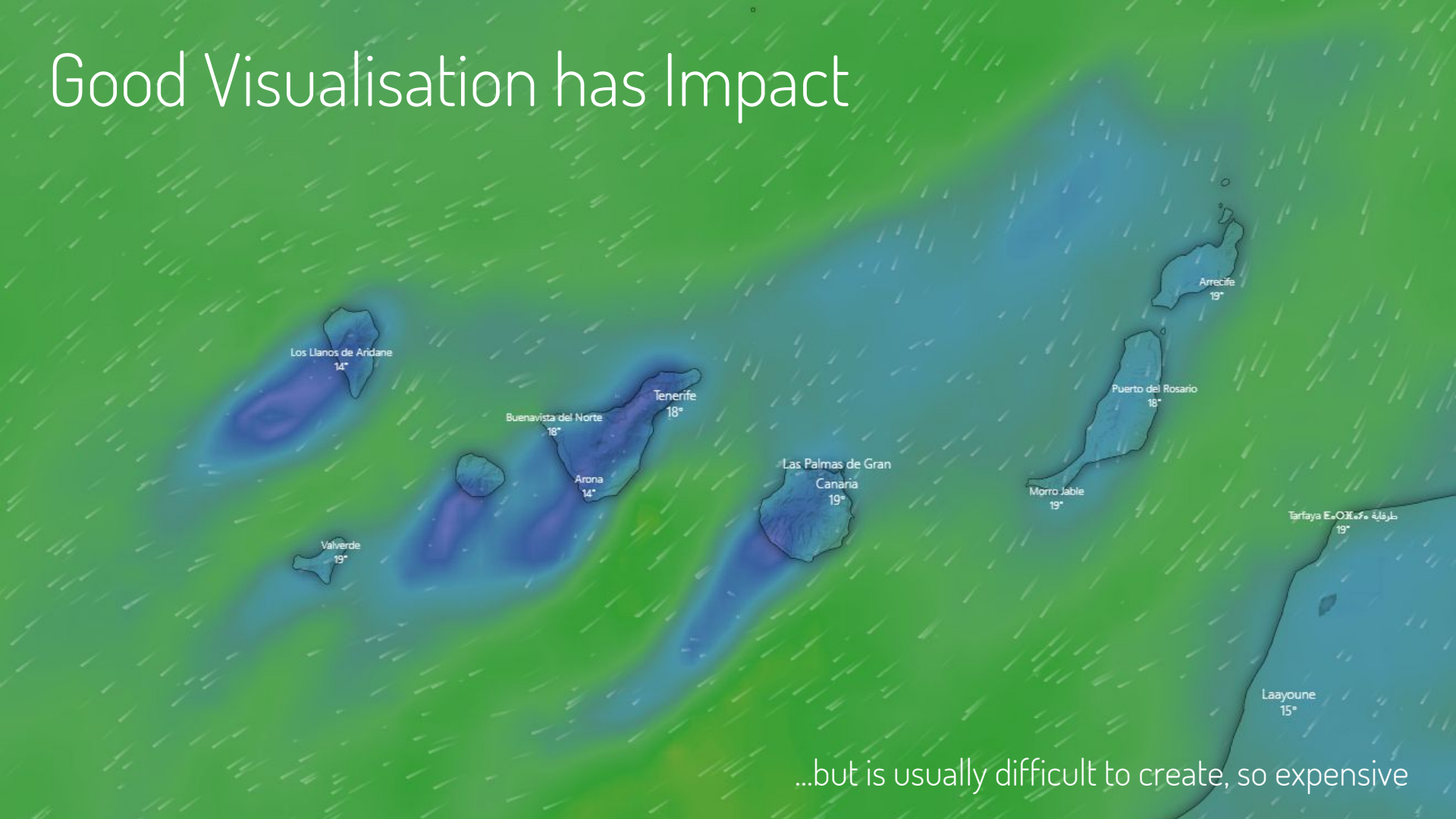
6 Months Ago

- 10% Python
- 90% Javascript

Last 3 Months

- 100% Python

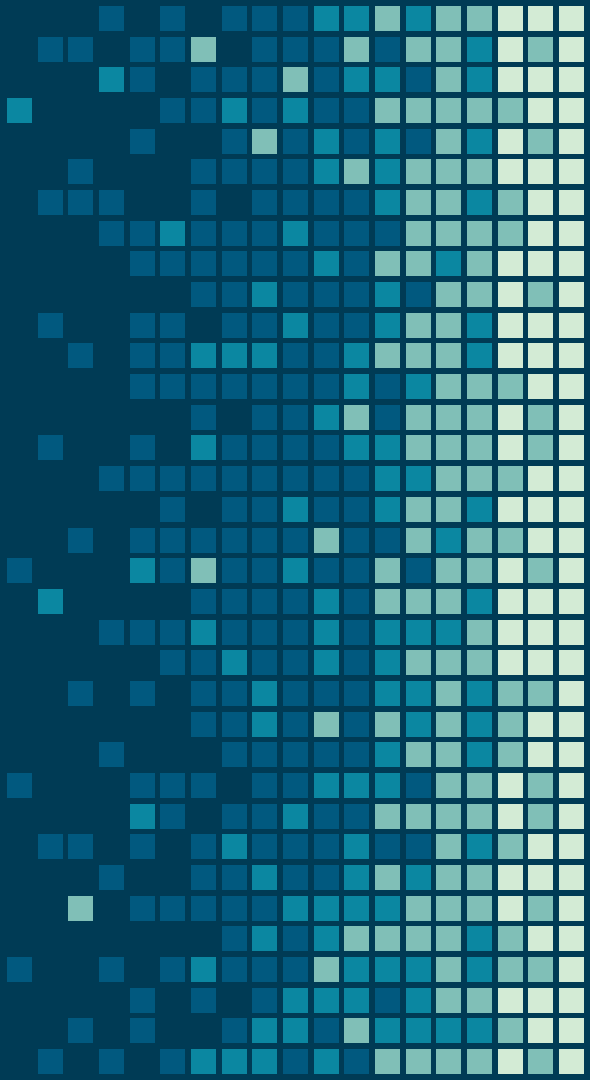
Good Visualisation has Impact

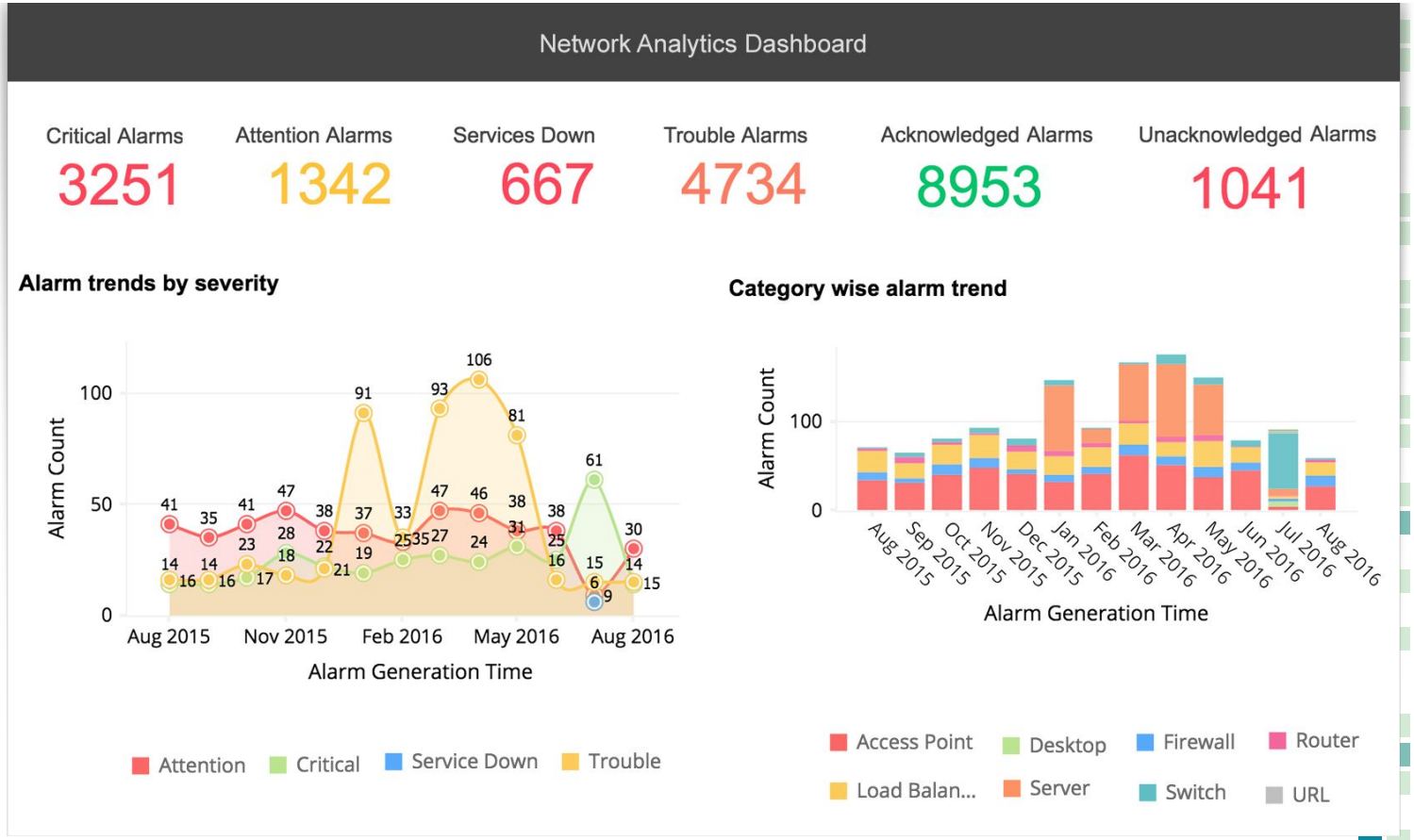


...but is usually difficult to create, so expensive

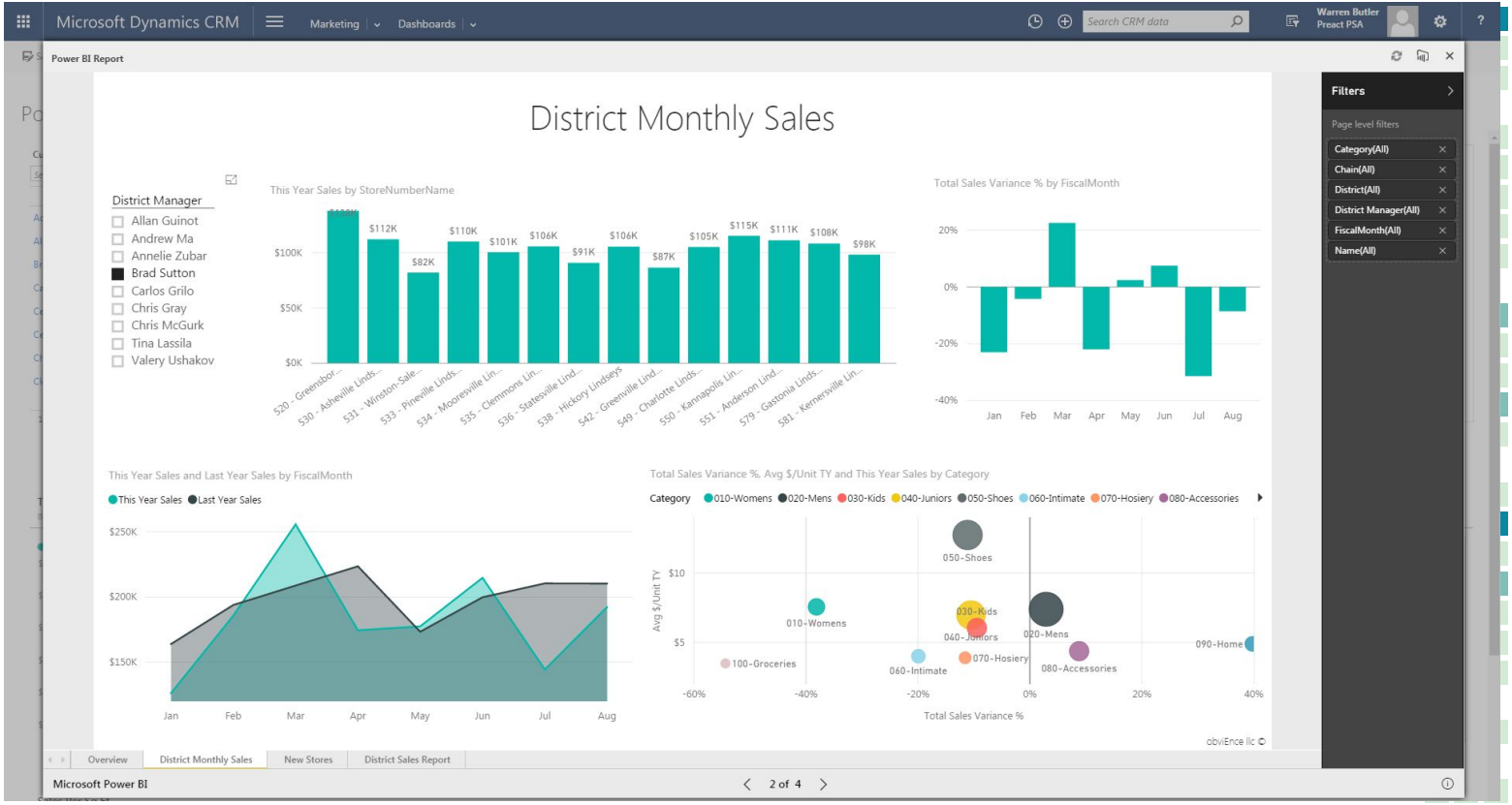
or maybe...

An Introduction to Vega & Vega-Lite

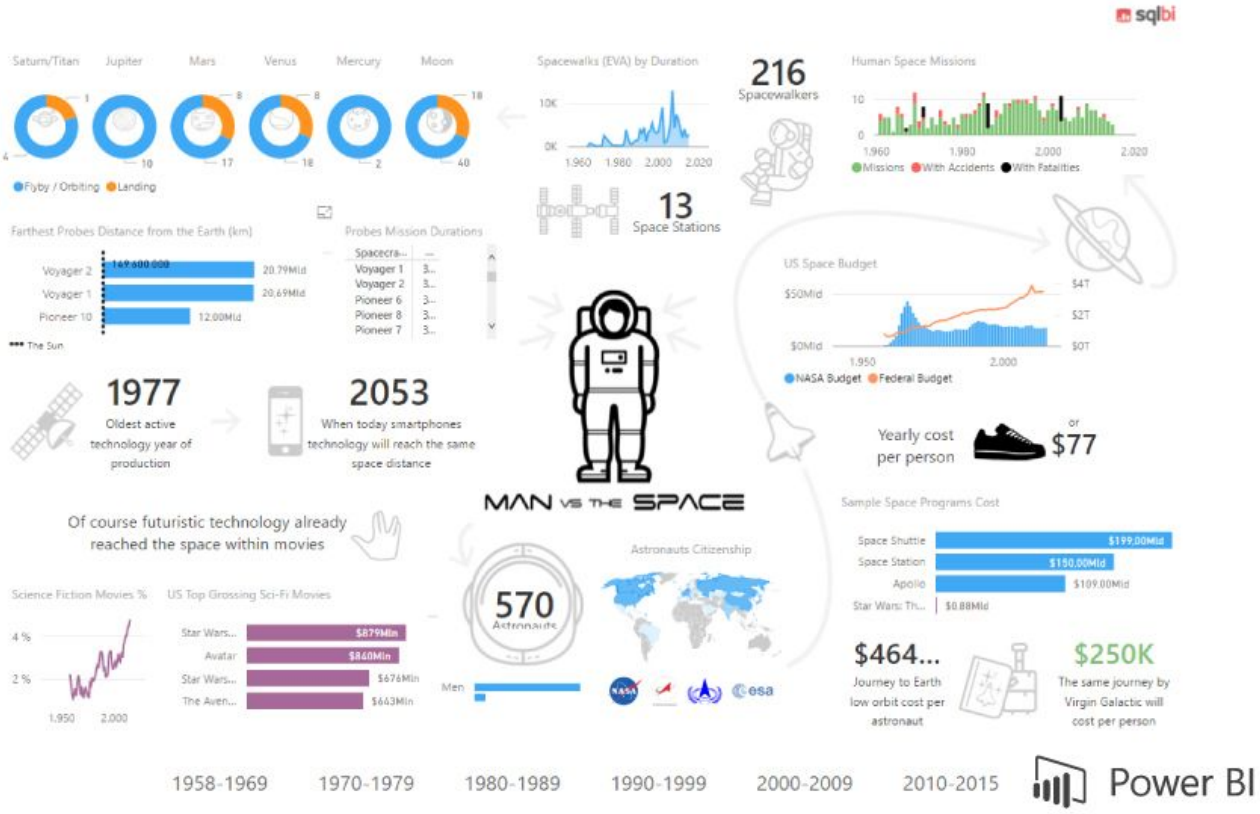




Use of data is getting richer and richer



And there is more of it, everywhere and clarity is as important as ever


sqlbi
Saturn/Titan
Jupiter
Mars
Venus
Mercury
Moon
Flyby / Orbiting
Landing
Spacewalks (EVA) by Duration
216
Spacewalkers
Human Space Missions
Missions
With Accidents
With Fatalities
13
Space Stations
Farthest Probes Distance from the Earth (km)
Voyager 2
Voyager 1
Pioneer 10
The Sun
Probes Mission Durations
US Space Budget
NASA Budget
Federal Budget
1977
Oldest active technology year of production
2053
When today smartphones technology will reach the same space distance
MAN VS THE SPACE
Yearly cost per person
or
$77
Of course futuristic technology already reached the space within movies
Sample Space Programs Cost
Space Shuttle
Space Station
Apollo
Star Wars: Th...
Science Fiction Movies %
US Top Grossing Sci-Fi Movies
Star Wars...
Avatar
Star Wars...
The Aven...
570
Astronauts
Men
Astronauts Citizenship
$464...
Journey to Earth low orbit cost per astronaut
$250K
The same journey by Virgin Galactic will cost per person
1958-1969
1970-1979
1980-1989
1990-1999
2000-2009
2010-2015
Power BI

maybe until...

Many Choices!

https://github.com/zingchart/awesome-charting

Awesome dataviz

awesome build passing

A curated list of awesome data visualizations frameworks, libraries and software. Inspired by awesome-python.

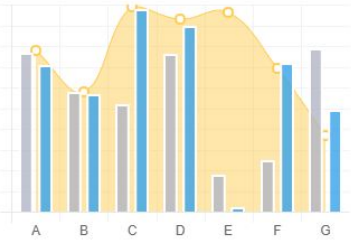
https://github.com/fasouto/awesome-dataviz

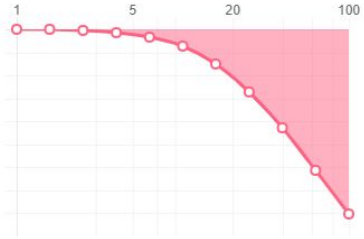
Well Known & Lightweight

Chart.js

New in 2.0 **Mixed chart types**

Mix and match bar and line charts to provide a clear visual distinction between datasets.





New in 2.0 **New chart axis types**

Plot complex, sparse datasets on date time, logarithmic or even entirely custom scales with ease.

New in 2.0 **Animate everything!**

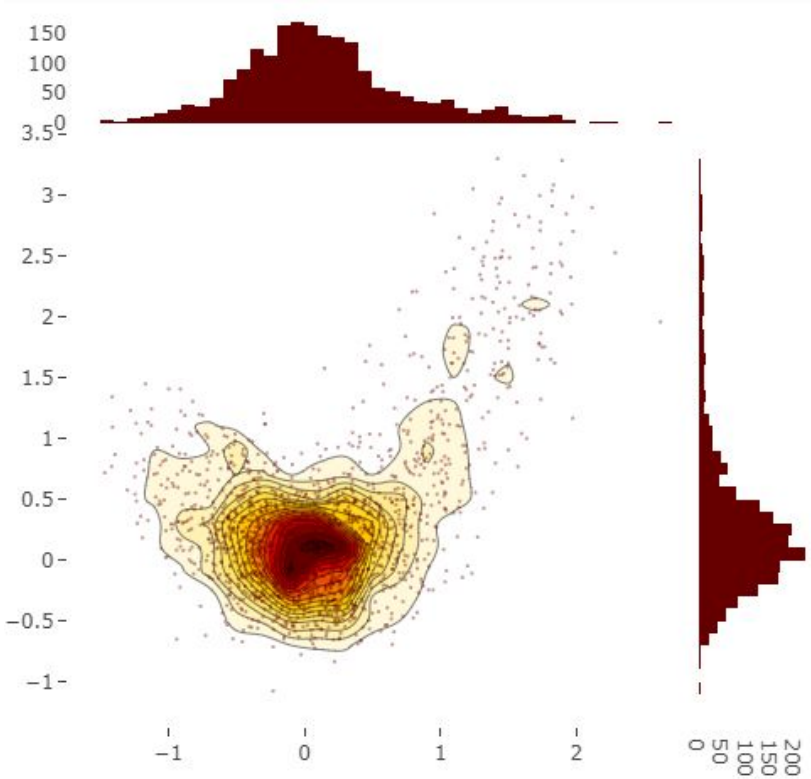
Out of the box stunning transitions when changing data, updating colours and adding datasets.

Fully Featured, Commercial Support

HIGHCHARTS

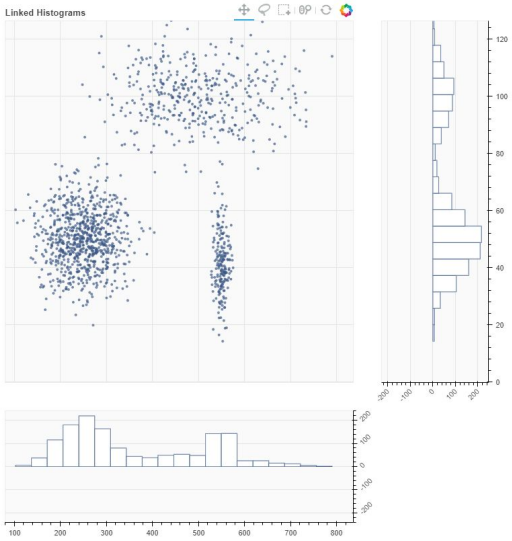
Hybrid

plotly.js

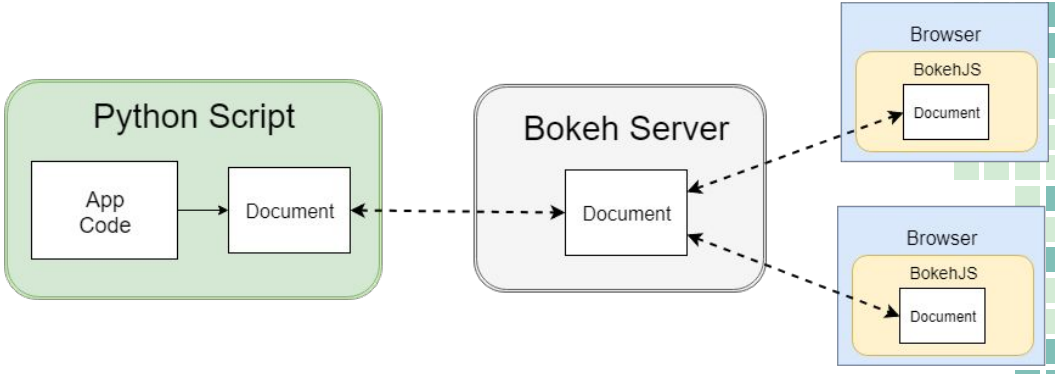


Where visualisation is at – the frontend

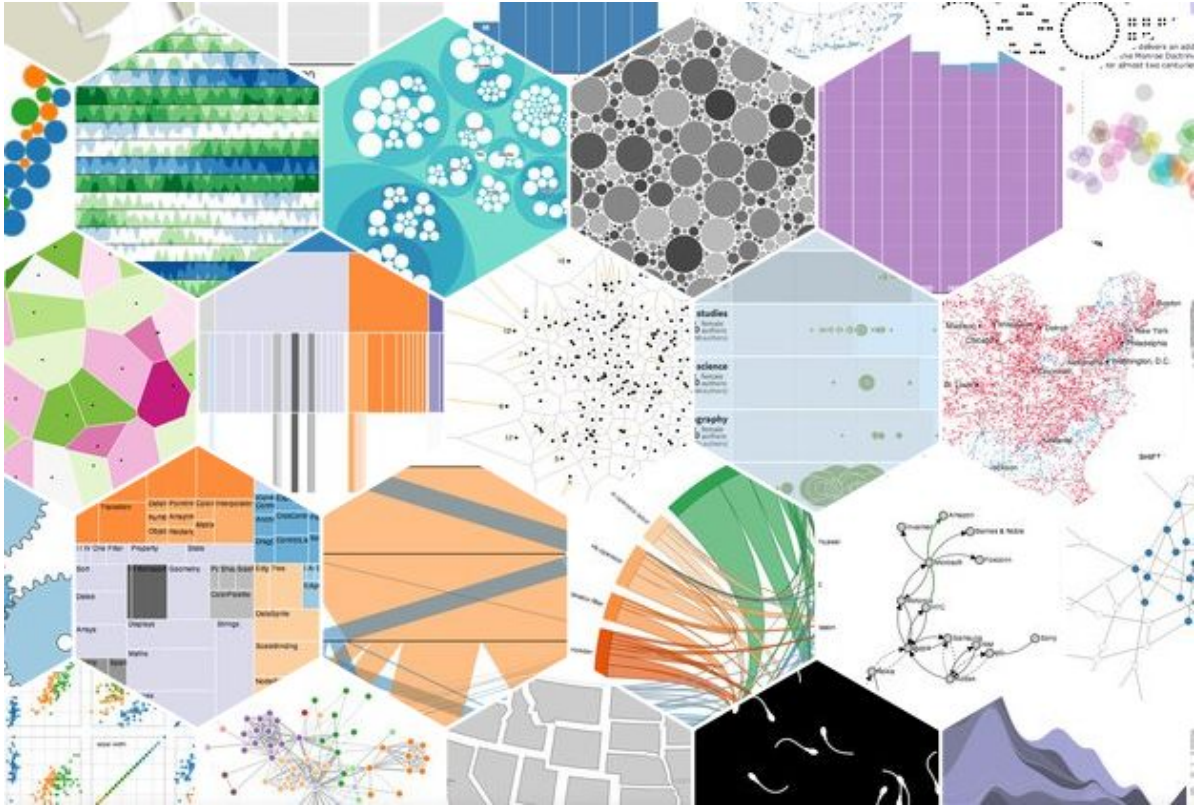
From the Python World



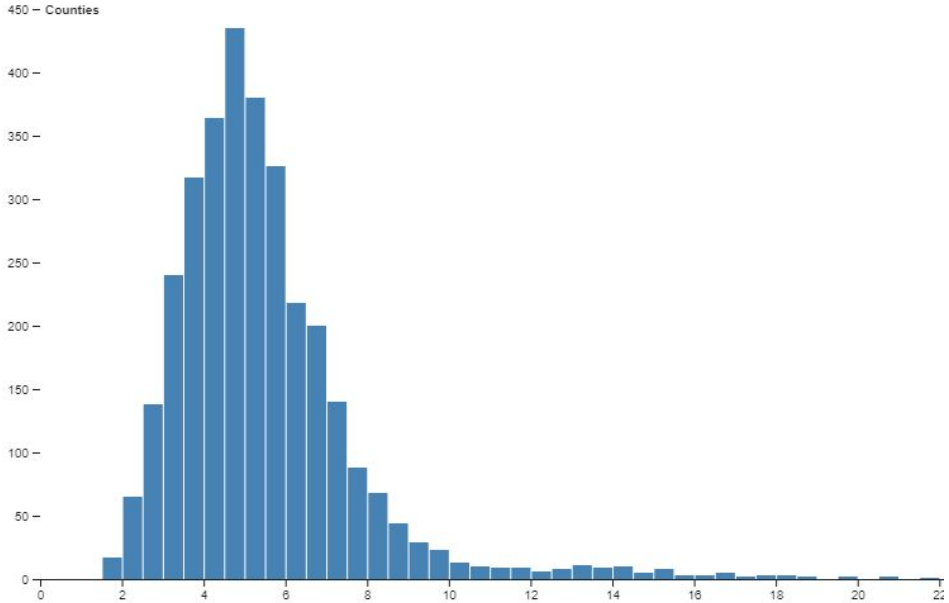
Bokeh / Bokeh.js



D3.js – Hardcore, Low Level, Powerful



D3 is amazing! Let's take a quick look




```
const svg = d3.select(DOM.svg(width, height));

const bar = svg.append("g")
    .attr("fill", "steelblue")
  .selectAll("rect")
  .data(bins)
  .enter().append("rect")
    .attr("x", d => x(d.x0) + 1)
    .attr("width", d => Math.max(0, x(d.x1) - x(d.x0) - 1))
    .attr("y", d => y(d.length))
    .attr("height", d => y(0) - y(d.length));

svg.append("g")
    .call(xAxis);

svg.append("g")
    .call(yAxis);

return svg.node();
```

What if?

we only needed to write a little json?

Declarative Visualisation

Vega & Vega-Lite

UW Interactive Data Lab VISUALIZATION + ANALYSIS

Declarative Specification / Programming

- Readability / usability
- Less Side effects
- Better separation of state from control flow
- Specify/Code the `End State`
- Reuse

About Vega

- Single .min.js download 425KB including d3
- Vega core 273KB
- Vega lite 208KB

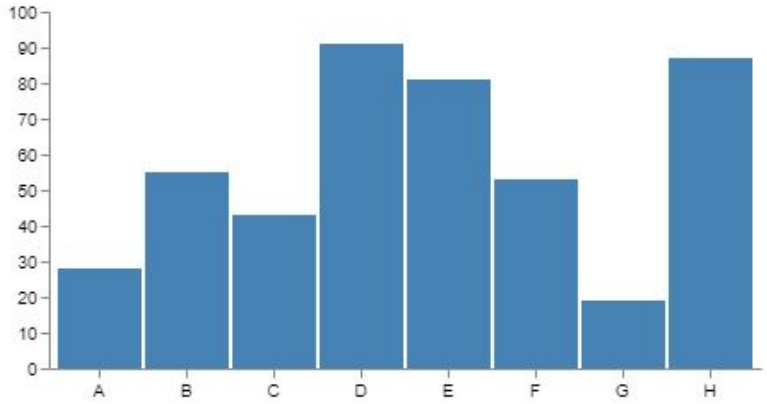
- Embed via a vegaEmbed('myspec.json')
- In JS using Vega View API

Vega

https://vega.github.io/vega/
https://vega.github.io/vega/docs/

Hello Vega

```
{
  "$schema":
"https://vega.github.io/schema/vega/v4.json
",
  "width": 400,
  "height": 200,
  "padding": 5,
  "data": ...,
  "signals": ...,
  "scales": ...,
  "axes": ...,
  "marks": ...
}
```



more examples

Vega Lite

More Power, Less Json

Vega Lite – Less is More

- Data - input data source
- Transform - filter, aggregation, binning…
- Mark - data-representative graphics
- Encoding - mapping data to mark properties
- Scale - mapping data values to visual values
- Guides - axes, legends, …

Hello Canarias

Hello Canarias

```
{
 "$schema": "https://vega.github.io/schema/vega-lite/v3.json",
 "data": {
      "url":
"https://raw.githubusercontent.com/JJ/top-github-users-data/master/data/processed/aggrega
ted-top-Canarias.csv"
 },
 "width": 600,
 "height": 400,
 "signals": [],
 "scales": [],
 "axes": [],
 "marks": []
}
```

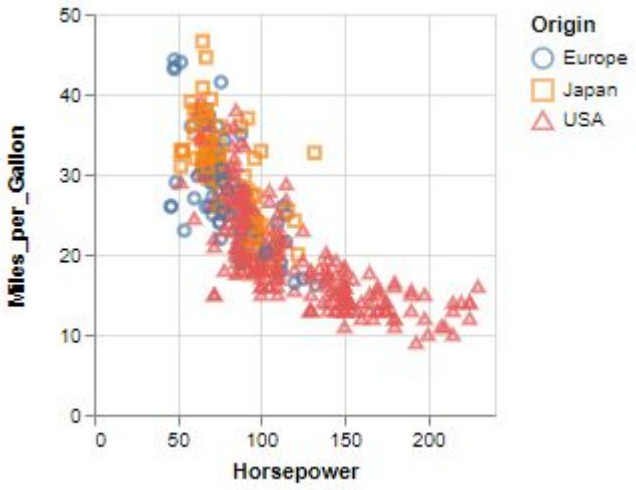
A Small Dataset

	login	location	place	followers	contributions	stars	user_stars	language
1	crguezl	La Laguna. Tenerife	Tenerife	100	1243	51	108	Ruby
2	Rayco	Canary Islands, Tenerife, Spain	Canarias	8	1122	0	0	JavaScript
3	ancorgs	Gran Canaria	Las Palmas	9	960	0	3	Ruby
4	axelhzf	Tenerife, Spain	Tenerife	23	670	53	118	JavaScript
5	pronebird	Canary Islands	Canarias	32	576	175	420	Objective-C
6	alu0100764666	Santa Cruz de Tenerife	Tenerife	1	407	0	0	Java
7	jonhattan	Canary Islands	Canarias	19	366	8	12	Puppet
8	Al3XKOoL	Tenerife. Canary islands. Spain	Canarias	0	331	5	0	Makefile
9	alu0100696691	Santa cruz de Tenerife, Islas Canarias, España	Canarias	11	322	2	0	Ruby
10	marcin-wosinek	Las Palmas de GC, Spain	Las Palmas	7	307	4	59	JavaScript
11	YaroSpace	Tenerife	Tenerife	7	292	1	10	Ruby
12	claunia	Las Palmas de Gran Canaria	Las Palmas	4	283	9	7	C#
13	stevejpurves	Santa Cruz de Tenerife, Spain	Tenerife	10	209	2	108	JavaScript
14	Suui	Las Palmas de Gran Canaria	Las Palmas	6	204	1	0	Java

Let’s try and build something

https://vega.github.io/editor/#/

Vega Lite Examples




```
[
  {
    "Name": "chevrolet chevelle malibu",
    "Miles_per_Gallon": 18,
    "Cylinders": 8,
    "Displacement": 307,
    "Horsepower": 130,
    "Weight_in_lbs": 3504,
    "Acceleration": 12,
    "Year": "1970-01-01",
    "Origin": "USA"
  },
  {
    "Name": "buick skylark 320",
    "Miles_per_Gallon": 15,
    "Cylinders": 8,
    "Displacement": 350,
    "Horsepower": 165,
    "Weight_in_lbs": 3693,
    "Acceleration": 11.5,
    "Year": "1970-01-01",
    "Origin": "USA"
  },
```


https://vega.github.io/vega-lite/data/cars.json

View Composition

- facet - multiple plots, subset of data
- layer - overlay multiple plots
- concat - multiviews
- *repeat - easier multiviews*

Remember aggregation…..

Interactivity

- Selections
  - Event processing
  - Points of interest
  - Predicate function
- Selection Transformations
  - Operators that modify a selection

Try it out

Single View

- Single
- Multi
- Painting (on: mouseover)
- Single Transform
- External Control

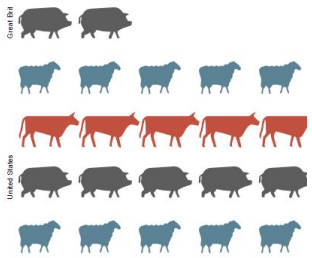
Multi View

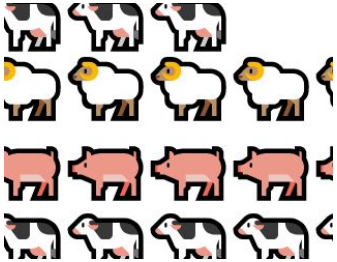
- Conditional (global, union, intersect)
- Translate

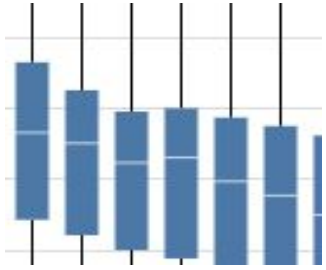
Vega-Lite Examples

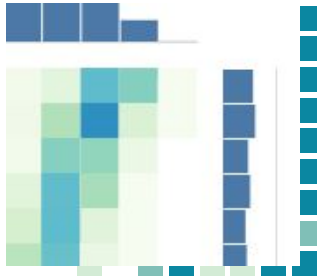
- Colored Scatterplot
- Colored Scatterplot with Widgets
- Colored SPLOM

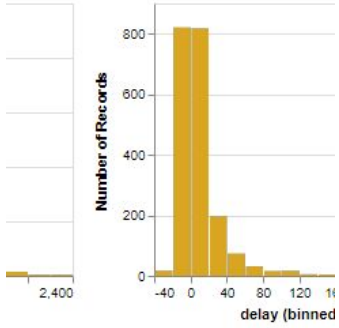
More Wow, Much Examples

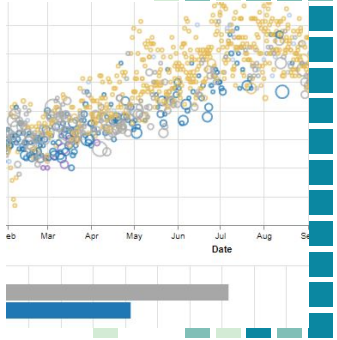












THANKS!

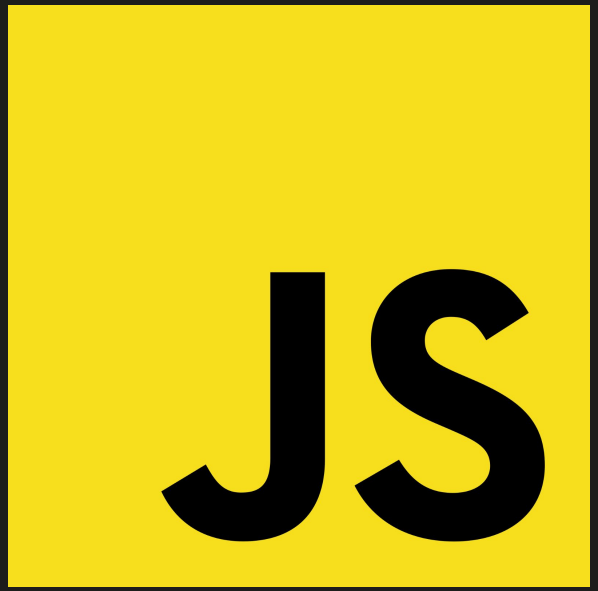
Any questions?

You can find me at:

@stevejpurves

stevejpurves@gmail.com

github.com/stevejpurves/js-day-canarias-2018-data-vis


JS