



# Introduction à D3.js

Cours #2

<https://lyondataviz.github.io/teaching/lyon1-m2/2017/>

Romain Vuillemot

# OUTLINE

HUMAN PERCEPTION: PREATTENTIVE FEATURES

VISUAL MAPPINGS

INTRODUCTION A D3.JS

VISUAL MAPPING & INTERACTION AVEC D3.JS

SIMPLE DATAVIZ AVEC D3.JS & BLOCKBUILDER

# [data-vis-jobs@googlegroups.com](mailto:data-vis-jobs@googlegroups.com)

Google Search for messages NEW TOPIC C Mark all as read Filters Groups Data-vis-jobs Shared publicly 30 of 746 topics (99+ unread) G+ Tags · Members · About

Welcome! This list is intended to help data visualization folks find, post, and share primarily contract jobs. We need this list because the number of data-vis related jobs has exploded, and it has become difficult to find talented workers to do these jobs -- Or to find other people to give your feelers to, when you're booked. The list will be tool agnostic, both static and/or interactive visualization work is welcome here. Possible skills I imagine living here: D3.js, Raphael.js, Processing / Processing.js, Paper.js, Flash, Illustrator, Excel, Tableau, R (ggplot2), Python - matplotlib / chaco / traits / bokeh / d3.py etc, Gephi/NodeXL/sigma.js.

The job postings will be moderated, to keep it on-target. To post to this group, send email to [data-vis-jobs@googlegroups.com](mailto:data-vis-jobs@googlegroups.com). Specify if it's full-time, contract, contract-to-hire; and whether remote work is ok. INCLUDE AN EMAIL ADDRESS FOR REPLIES IN THE BODY OF YOUR TEXT. Replies that get sent to the list address will be blocked from appearing!

- Best, Lynn (@arnicas)

**Stamen is hiring a design technologist to work at our busy dataviz design studio in San Francisco (1)**  
By Eric Rodenbeck - 1 post - 14 views Nov 7

**Looking for a graphic design intern (paid) (1)**  
By Rebecca Galloway - 1 post - 9 views Nov 7

**Looking for a Front End Developer (1)**  
By Rebecca Galloway - 1 post - 8 views Nov 7

**Post-Doctoral Position in Data-Driven Video Stories (1)**  
By Jonathan Hook - 1 post - 28 views Nov 5

**Seeking "Complex Starburst" Chart Developer - Contract (1)**  
By Matthew Tutty - 1 post - 43 views Nov 5

**Design internship with data visualization studio - Washington, DC (1)**  
By William Merrow - 1 post - 66 views Oct 25

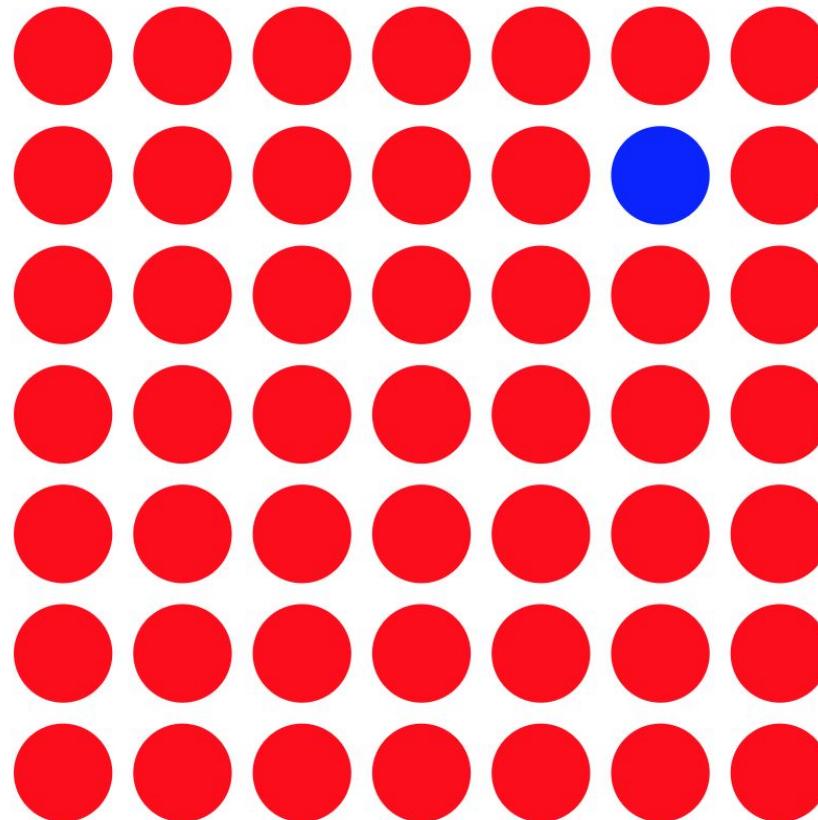
**D3.js and REACT.js to re-build Data Vis Platform (1)**  
By Samantha Epstein King - 1 post - 92 views fulltime newyork Oct 24

**6-Month Paid Internship in Interaction Design and Data Visualization in Zurich, Switzerland (1)**  
By Solange Vogt - 1 post - 75 views Oct 23

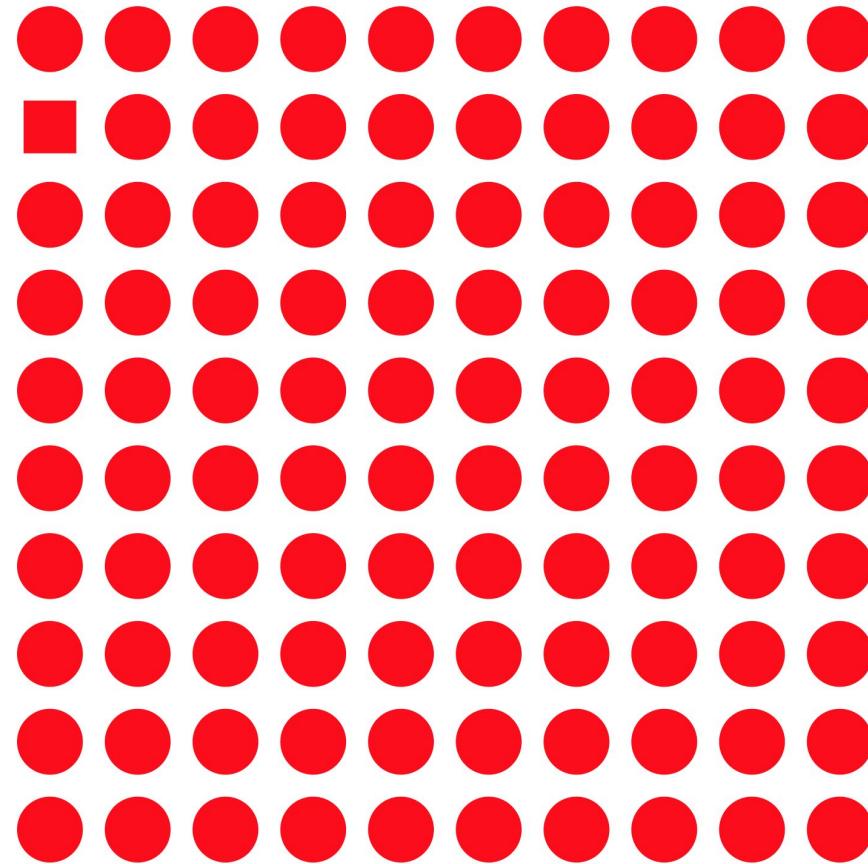
**Parse.ly is hiring a frontend / UI / UX engineer (1)**  
By Andrew Montalenti - 1 post - 97 views Oct 20

# HUMAN PERCEPTION

IS THERE A BLUE CIRCLE?



IS THERE A RED SQUARE?



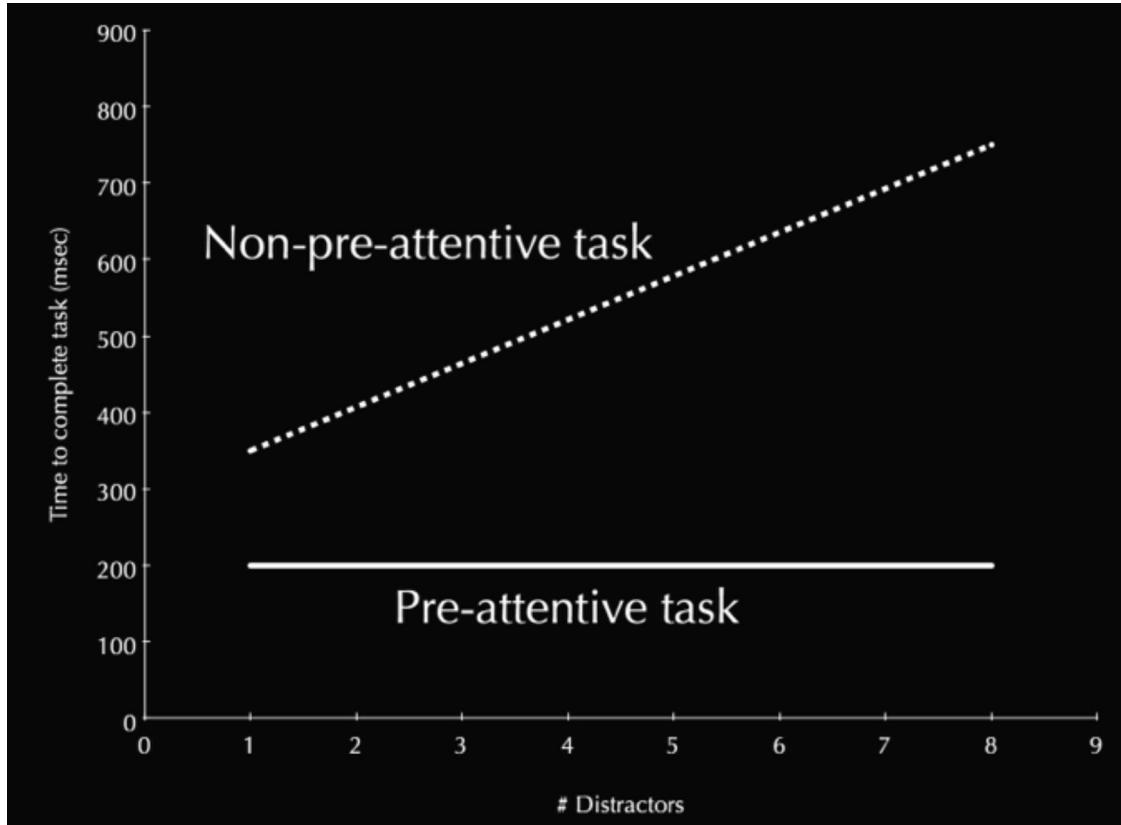
# FIND NUMBER 3

142416496357598475921765968474891728482  
285958819829450968504850695847612124044  
074674898985171495969124567659608020860  
608365416496457590643980479248576960781  
285960799918712845268101495969124567781  
874241649645757659608149596912456701285  
960799164964575127879918712845298496912  
223591649645759588198250963576596080596

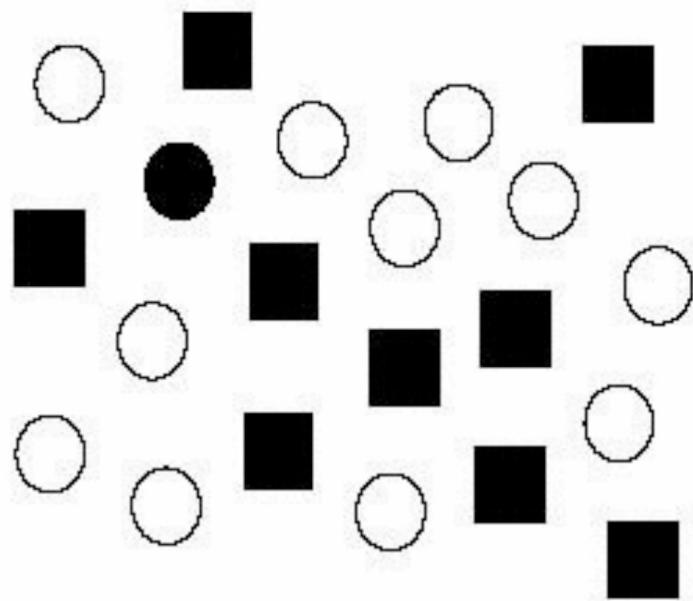
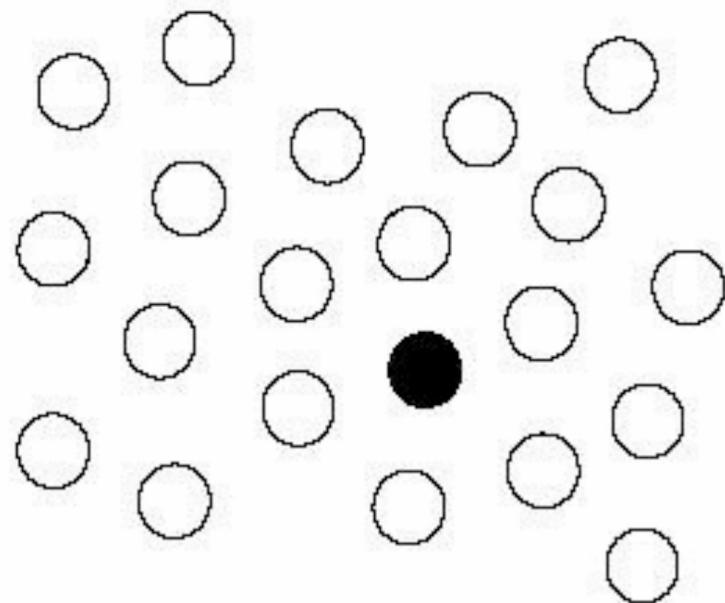
## FIND NUMBER 3

142416496**3**57598475921765968474891728482  
285958819829450968504850695847612124044  
074674898985171495969124567659608020860  
608**3**6541649645759064**3**980479248576960781  
285960799918712845268101495969124567781  
874241649645757659608149596912456701285  
960799164964575127879918712845298496912  
22359164964575958819825096**3**576596080596

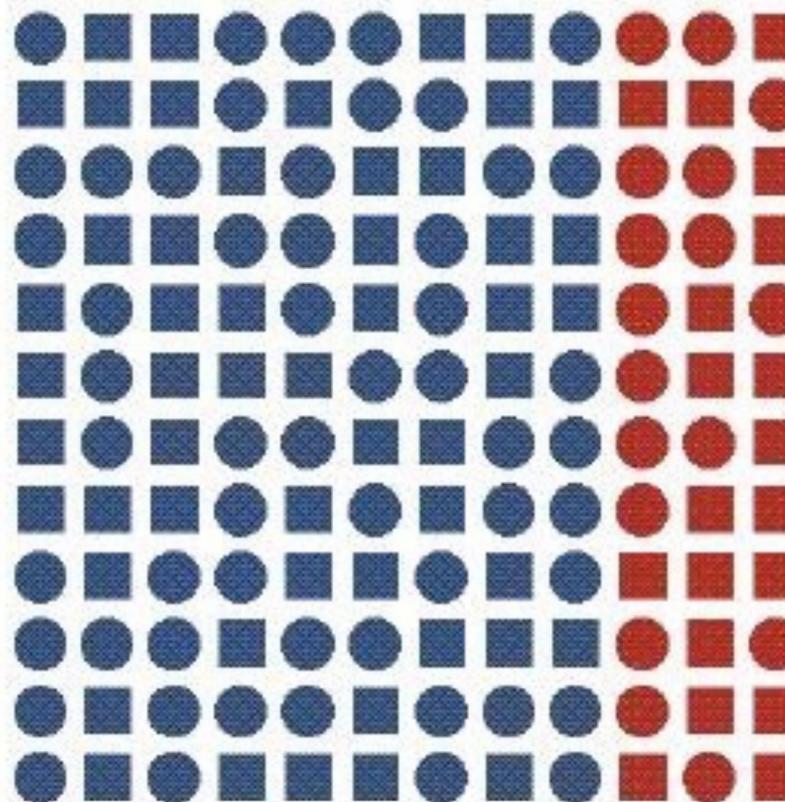
# PRE-ATTENTIVE PERCEPTION



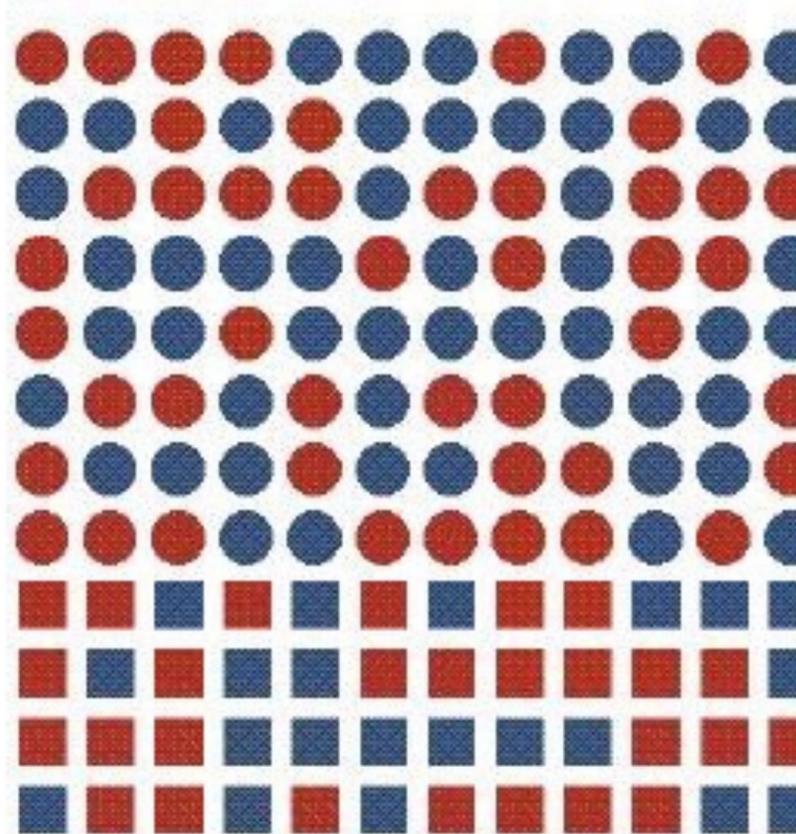
PRE-ATTENTIVE PERCEPTION ONLY WORK WHEN 1 DIFFERENCE



IS THERE A BORDER?

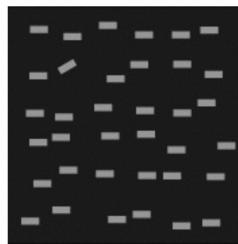


IS THERE A BORDER?

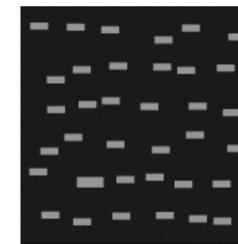


# OTHER PRE-ATTENTIVE FEATURES

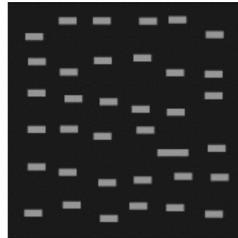
**orientation**



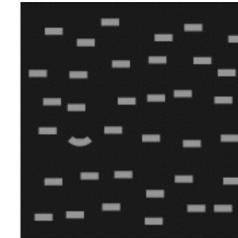
**size**



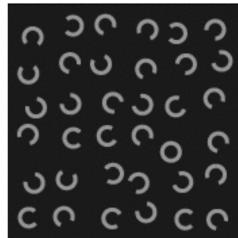
**length, width**



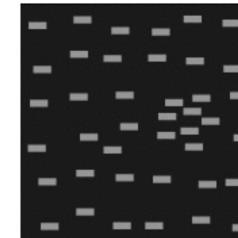
**curvature**



**closure**



**density, contrast**



# Visual Mappings

# TOOLS (GOOGLE VISUALIZATION)

Overview

Hello, Charts!

Quickstart

Load the Charts Library

Prepare the Data

Customize the Chart

Draw the Chart

Draw Multiple Charts

Chart Types

Chart Gallery

Annotation Charts

Area Charts

Bar Charts

Bubble Charts

Calendar Charts

Candlestick Charts

Column Charts

Combo Charts

Diff Charts

Donut Charts

Gantt Charts

Gauge Charts

GeoCharts

Histograms

Intervals

Line Charts

Maps

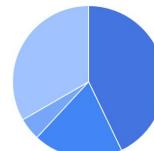
Org Charts

Pie Charts

Sankey Diagrams

Scatter Charts

### Pie Chart



### Bubble Chart



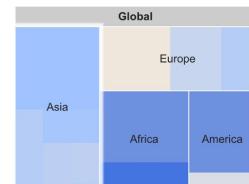
### Donut Chart



### Org Chart

```
graph TD; May[May President] --> Jerry[Jerry Vice President]; May --> Chris[Chris]; May --> Jordan[Jordan]; Jerry --> Kent[Kent]; Jerry --> Mitch[Mitch Intern]; Kent --> Cleaners[Cleaners]
```

### Treemap



### Table

Name	Salary	Full Time
1 Marie	\$24,700	✓
2 Albert	\$25,200	x
3 Enrico	\$25,700	✓
4 Lise	\$26,600	✓

### Timeline

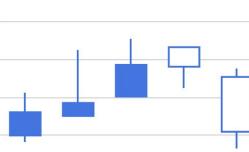


1800

### Gauge

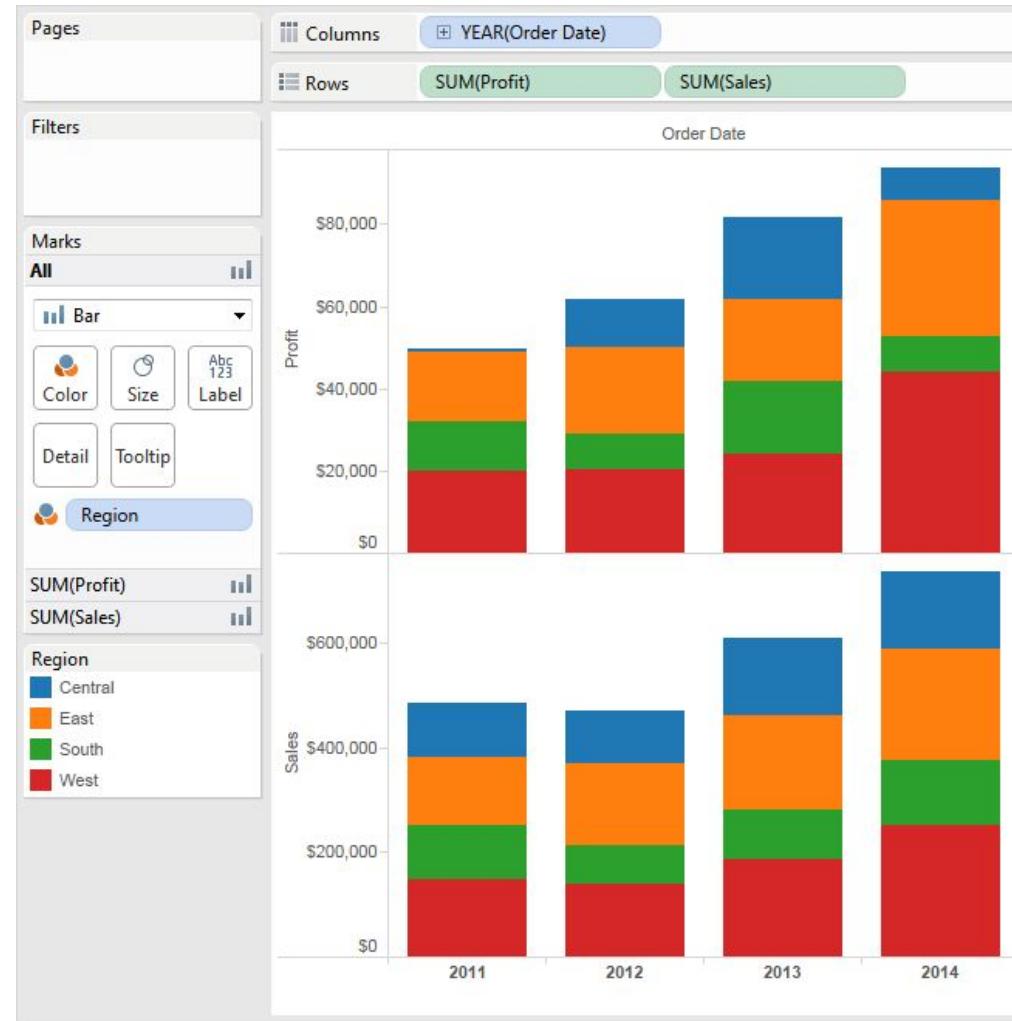


### Candlestick Chart



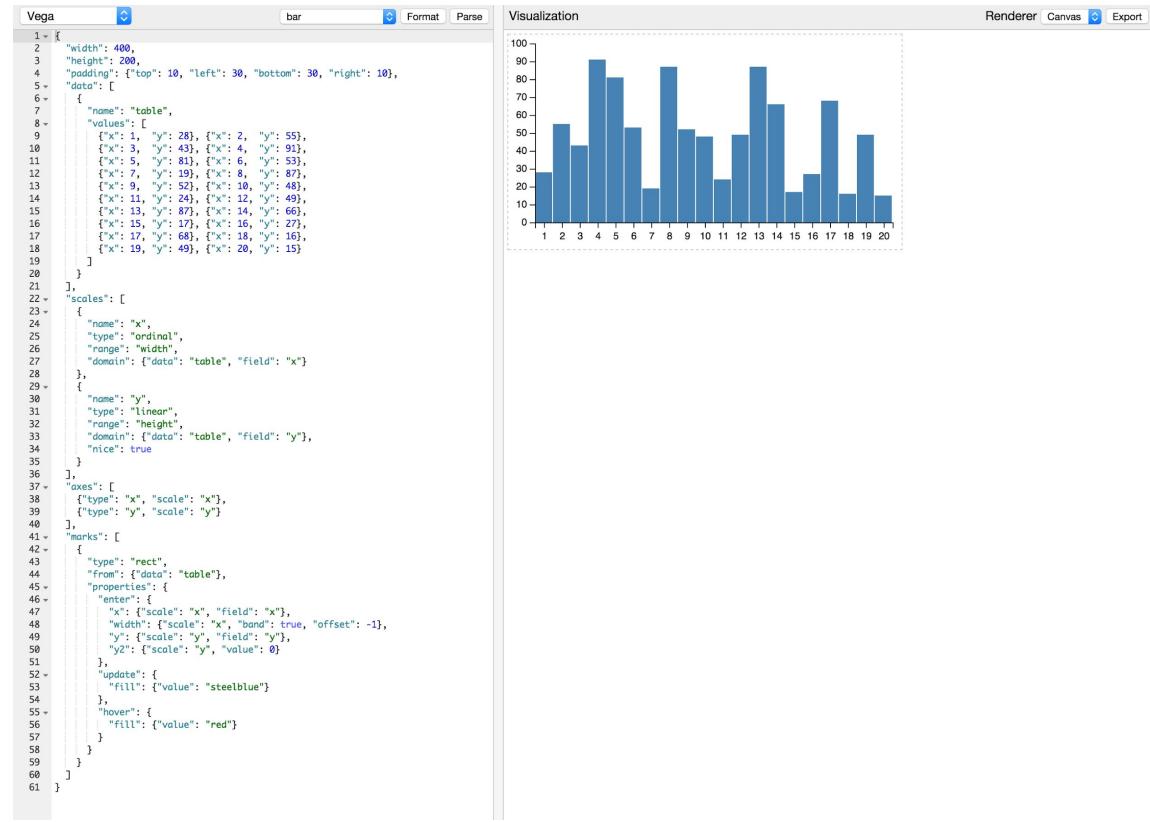
<https://developers.google.com/chart/interactive/docs/reference>

# TOOLS (TABLEAU)



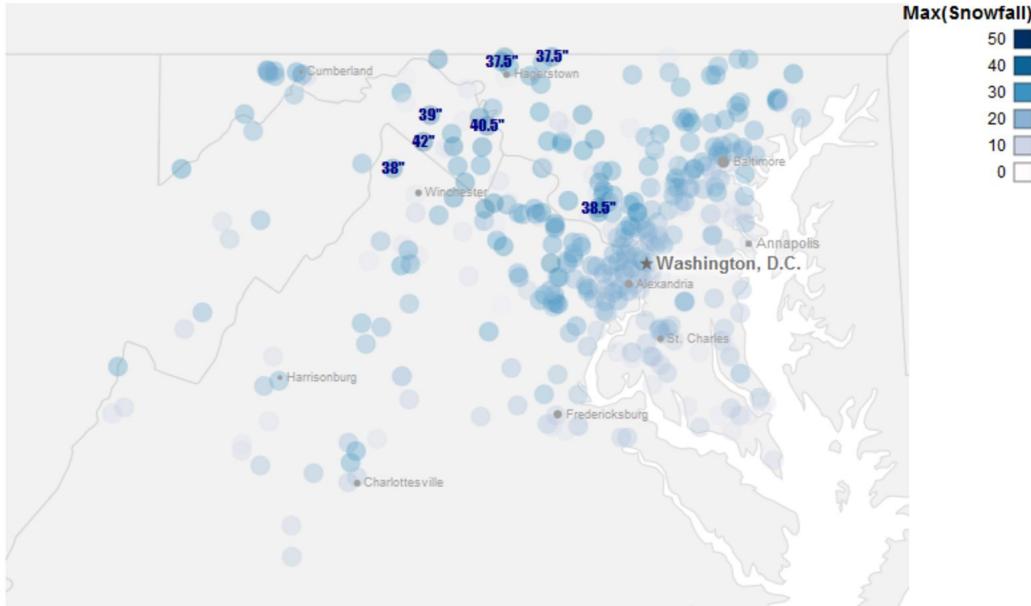
<https://www.tableau.com/>

# TOOLS (VEGA)



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

# TOOLS (BRUNEL)

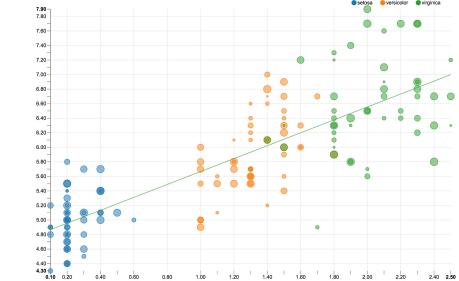
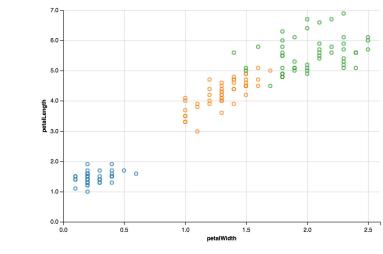
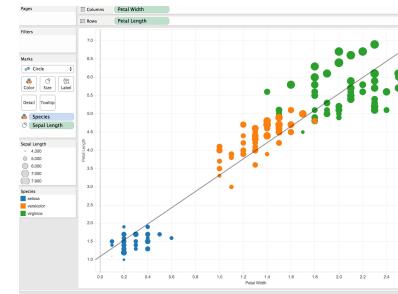
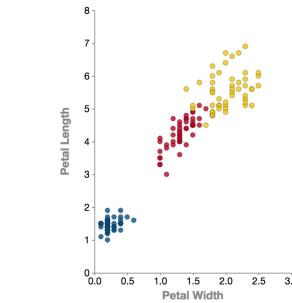
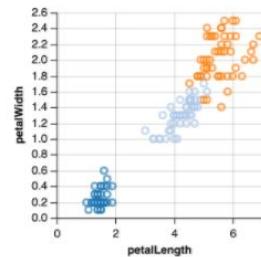
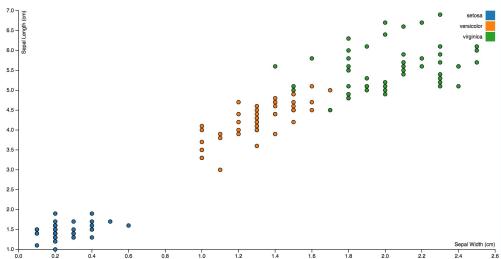


Brunel Code:

```
map('usa') + x(Lat) y(Lon) max(Snowfall) color(Snowfall:blues) tooltip(City,Snowfall) style("stroke-width:0;opacity:.4;size:15px") +
map('labels') + x(Lat) y(Lon) max(Snowfall) top(Snowfall:10) label(Snowfall, '') text style("font-family:Impact;fill:darkblue") tooltip(City,Snowfall)
```

<https://developer.ibm.com/code/open/brunel-visualization/>

# TOOLS LOOK&FEEL + DEFAULT



D3.JS

# D3.js <https://d3js.org/>

Créé ~ 2011 par Mike Bostock et al.

Bostock, Michael, Vadim Ogievetsky, and Jeffrey Heer. "*D<sup>3</sup> data-driven documents.*" IEEE transactions on visualization and computer graphics 17.12 (2011).

Descendant d'une longue lignée de toolkits (Stanford): Prefuse (Java), Flare (Flash), Protovis (JavaScript)

Top-10 des repositories les [plus populaires](#) sur Github

## D3.js <https://d3js.org/>

💡 D3 (Data-Driven Documents or D3.js) is a **JavaScript library** for visualizing data using **web standards**. D3 helps you bring data to life using SVG, Canvas and HTML. D3 combines powerful visualization and interaction techniques with a **data-driven approach to DOM manipulation**, giving you the full capabilities of modern browsers and the freedom to design the right visual interface for your data.

<https://github.com/d3/d3/wiki>

>> D3 is a visualization kernel

# Similarités avec jQuery

```
d3.select('#foo')
  .style('background', '#000')
  .on('click', function() {})
  .append('div');

$('#foo')
  .css('background', '#000')
  .click(function() {})
  .append($('<div></div>'));

// Sélection en pur JS
function $(x) {
  return document.querySelectorAll(x);
}
```



# Rappel de CSS

```
<style>
  body { margin:0;position:fixed;top:0;right:0;bottom:0;left:0; }
  rect {
    fill: none;
    stroke: black;
    stroke-width: 1px;
  }
</style>
```

# Rappel de SVG



# De très nombreux exemples!

D3.js official website <https://d3js.org/> & documentation

D3 Blocks <http://bl.ocks.org/mbostock/>

Examples <https://bost.ocks.org/mike/example/>

Big List par Christian Viau <http://christopheviau.com/d3list/>

Blockbuilders (live coding) <http://blockbuilder.org/>

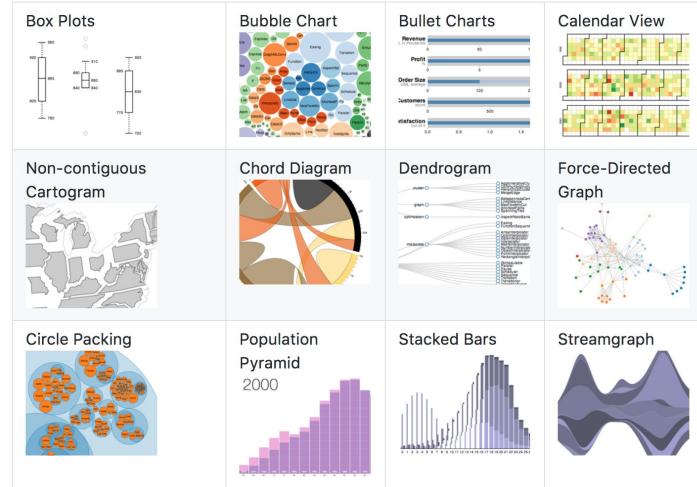
## Gallery

Mike Bostock edited this page 5 days ago · 1260 revisions

[Wiki](#) ▶ [Gallery](#)

Welcome to the **D3 gallery**! More examples are available on [bl.ocks.org/mbostock](http://bl.ocks.org/mbostock). If you want to share an example and don't have your own hosting, consider using [Gist](#) and [bl.ocks.org](http://bl.ocks.org). If you want to share or view live examples try [runnable.com](http://runnable.com) or [vida.io](http://vida.io).

## Visual Index



# BlockBuilder

Created by <https://github.com/enjalot>

Open Source

<https://github.com/enjalot/blockbuilder>

Based on GitHub hosting

Create a block from scratch

Search a block

Fork a block

## Search the Bl.ocks

Showing 100/7011 of the most relevant blocks.

Simple modification based on mbostock's Bullet Charts.  
@enjalot

dance 5  
@enjalot

Simple modification based on mbostock's Bullet Charts.  
@drrock

JS head or before body close?  
@ingdonohue

Woman (height)

Treemap MS PowerBI  
@alzemberg

Closest Point on a Path and Its Tangent II (faster tangent method)  
@andreas87

```
<!DOCTYPE html>
<head>
  <meta charset="utf-8">
  <script src="https://d3js.org/d3.v3.min.js"></script>
  <style>
    body { margin:0;position:fixed;top:0;right:0;bottom:0;left:0; }
    rect {
      fill: none;
      stroke: black;
      stroke-width: 1px;
    }
  </style>
</head>
<body>
  <script>
    // Feel free to change or delete any of the code you see in this editor!
    var svg = d3.select("body").append("svg")
      .attr("width", 960)
      .attr("height", 500)
      .style("border", "1px solid black");
    var data = [22, 32, 21, 23, 10, 22, 11, 19, 30, 56];
    data.forEach(function(d) {
      var rect = svg.append("rect")
        .attr("x", function() {
          return 10 + d * 80 / 960;
        })
        .attr("y", 10)
        .attr("width", 60 / 960)
        .attr("height", 40);
    });
  </script>
</body>
```

NEED A GitHub ACCOUNT!

<https://lyondataviz.github.io/teaching/lyon1-m2/2017/>

# D3 v3 → D3 v4

<https://github.com/d3/d3/blob/master/CHANGES.md>

<https://github.com/d3/d3/wiki/time-formatting>

Most D3 functions are now modules

```
<script src="https://d3js.org/d3.v4.min.js"></script>
```

```
<script src="https://d3js.org/https://d3js.org/d3-random.v1.js"></script>
```

d3 / d3

Code

Issues 3

Pull requests 0

Wiki

Insights

## Time Formatting

Mike Bostock edited this page on Jun 30, 2016 · 41 revisions

This page has moved!

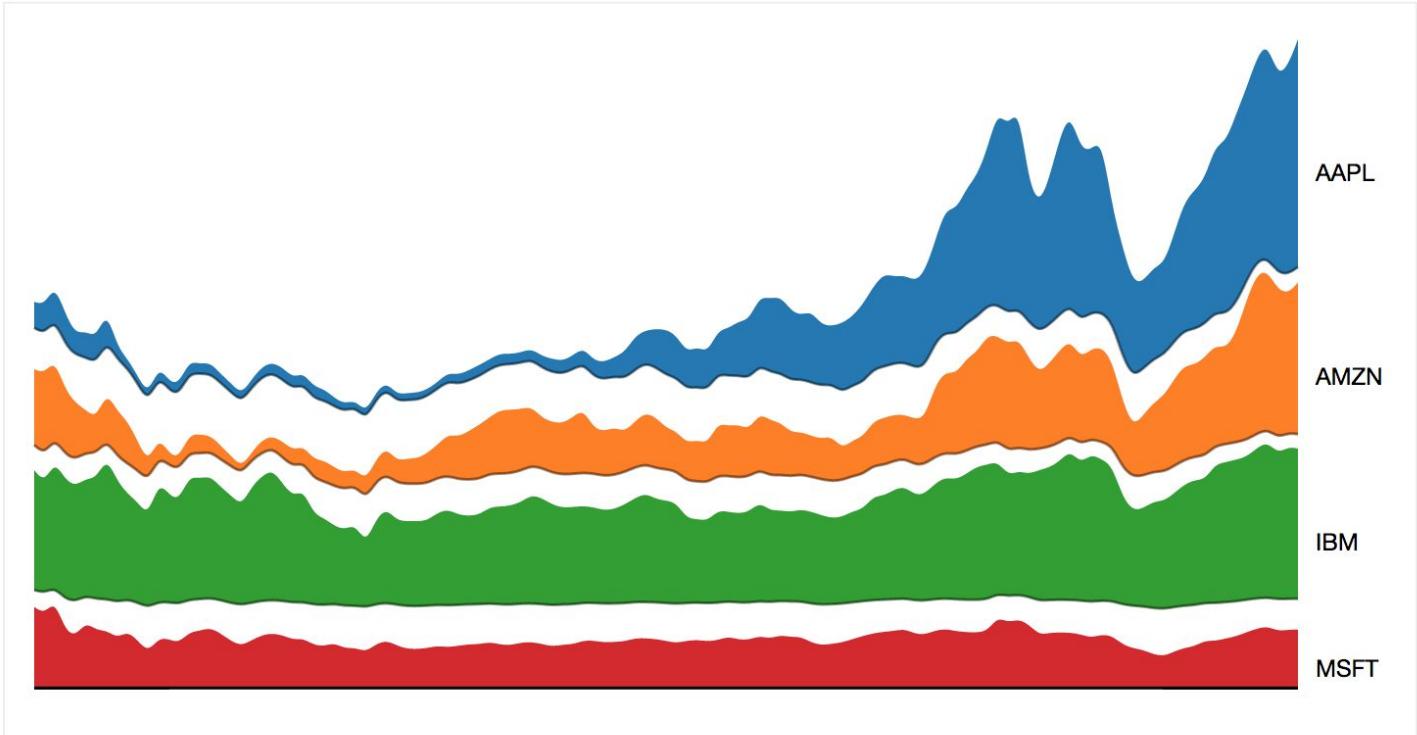
See the [D3 4.0 API Reference](#).

See the [Changes in D3 4.0](#).

See the [D3 3.x API Reference](#).

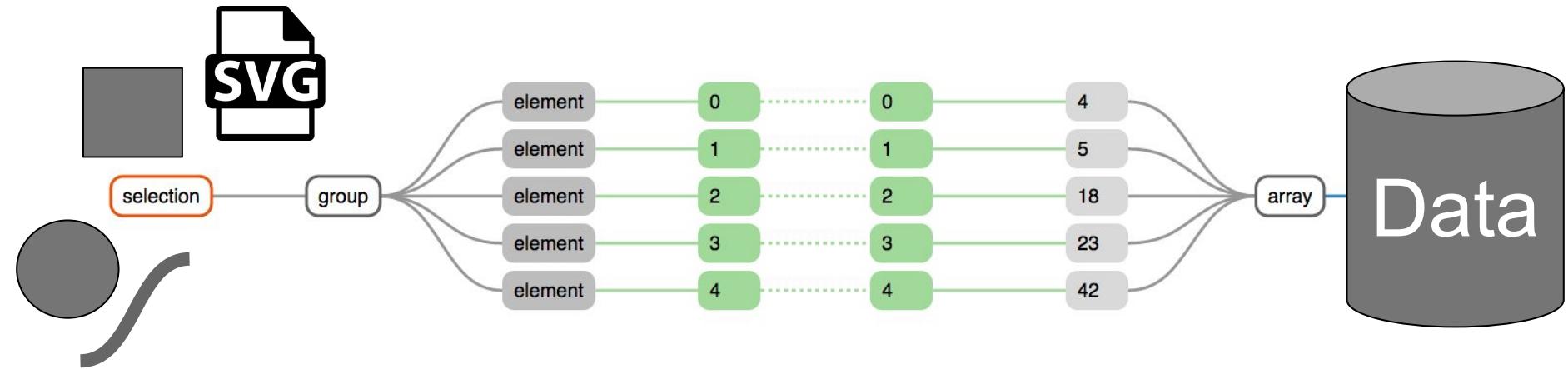
# D3 Show Reel

<https://bl.ocks.org/mbostock/1256572>



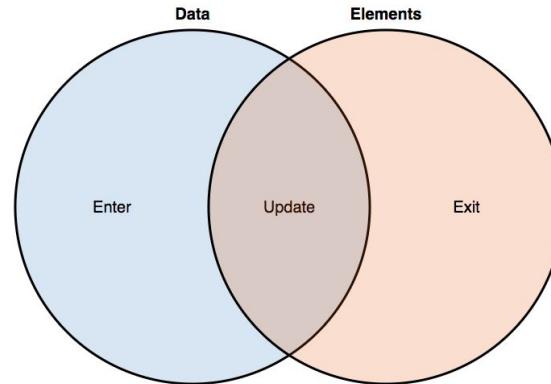
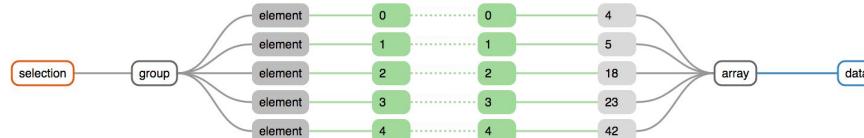
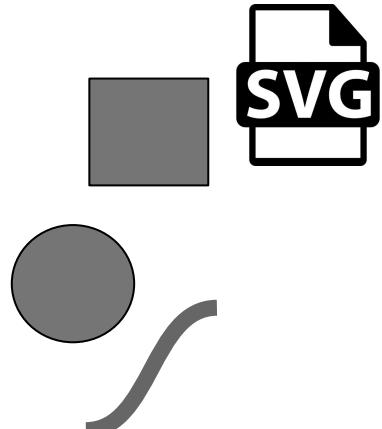
# D3 Fundamentals

# D3.js principe de base (data binding)



<https://bostocks.org/mike/selection/>

# D3.js principe de base (data binding)



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

Data binding <http://kristw.github.io/d3-data-binding/>

# D3.js principe de base (data binding)

`.data( [1,2,3,4] )`

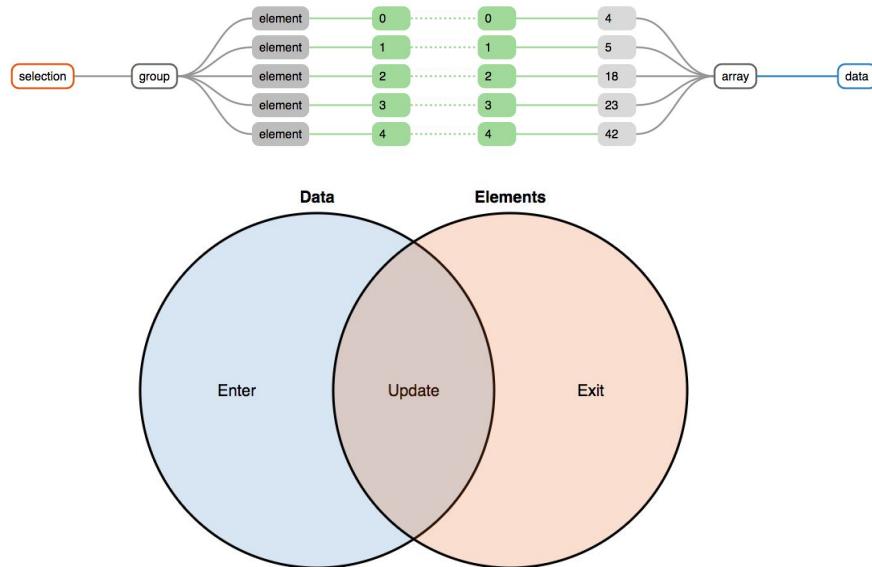
- Enter: [1,2,3,4]
- Update: [1,2,3,4]
- Exit: [ ]

• `.data ( [1,2,3,4,5,6] )`

- Enter: [5,6]
- Update: [1,2,3,4,5,6]
- Exit: [ ]

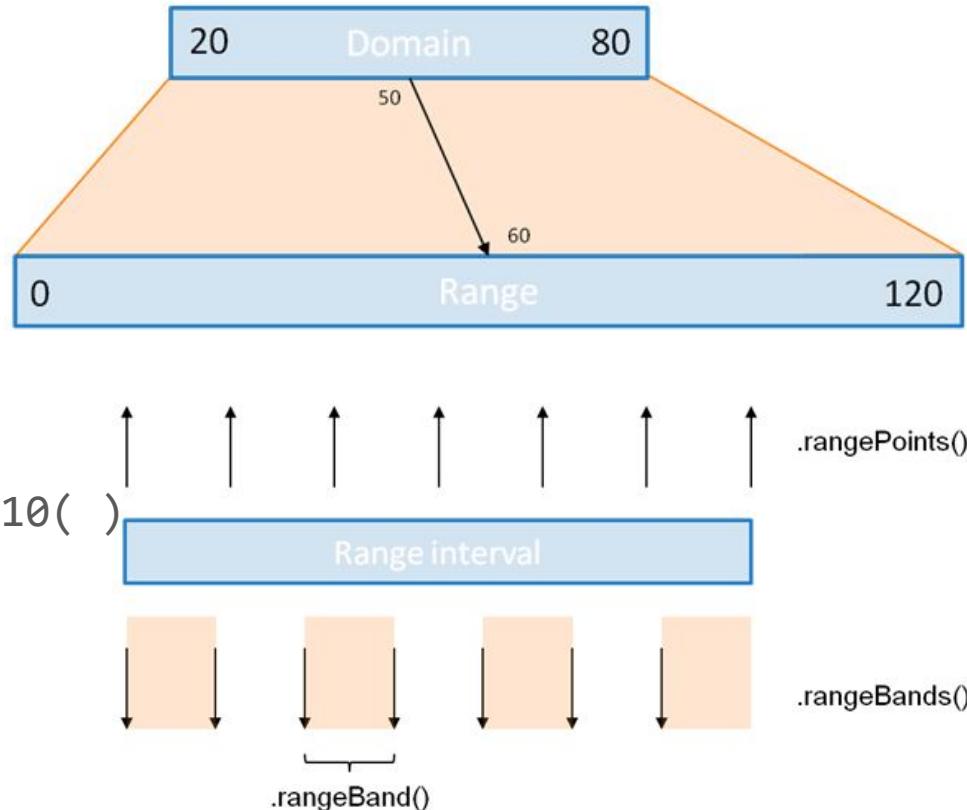
• `.data ( [1,2,3] )`

- Enter: [ ]
- Update: ???
- Exit: [4,5,6]



# D3.js principe de base (scales)

```
var xscale = d3.scale.linear( )  
.domain( [min, max] )  
.range( [minOut, maxOut] )  
  
group.attr("x", function(d,i) {  
    return xscale(d.size);  
})  
  
var colorscale = d3.scale.category10( )  
.attr("fill",function(d,i) {  
    return colorscale(d.type)  
})
```



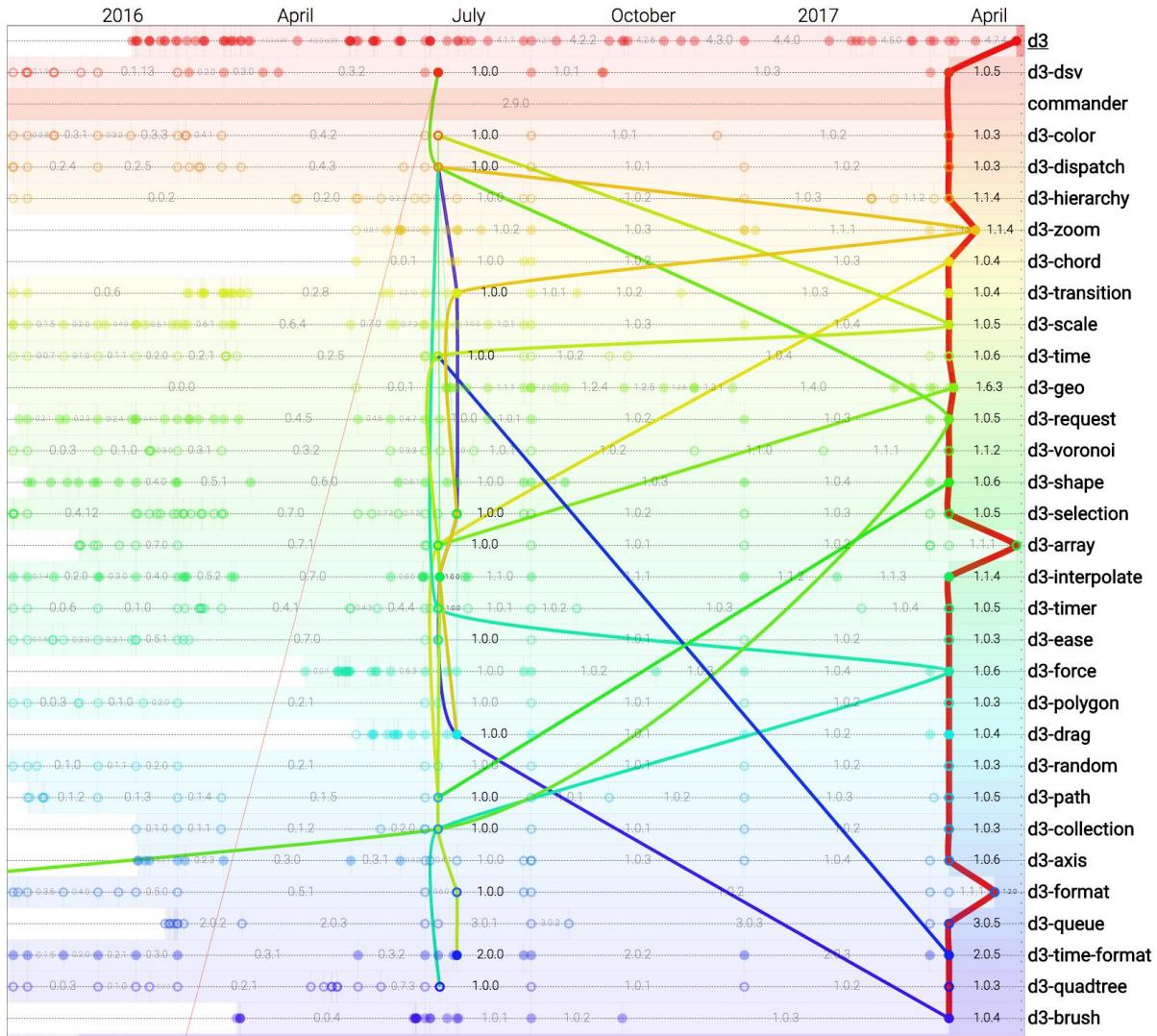
# D3 v3 → D3 v4 (again!)

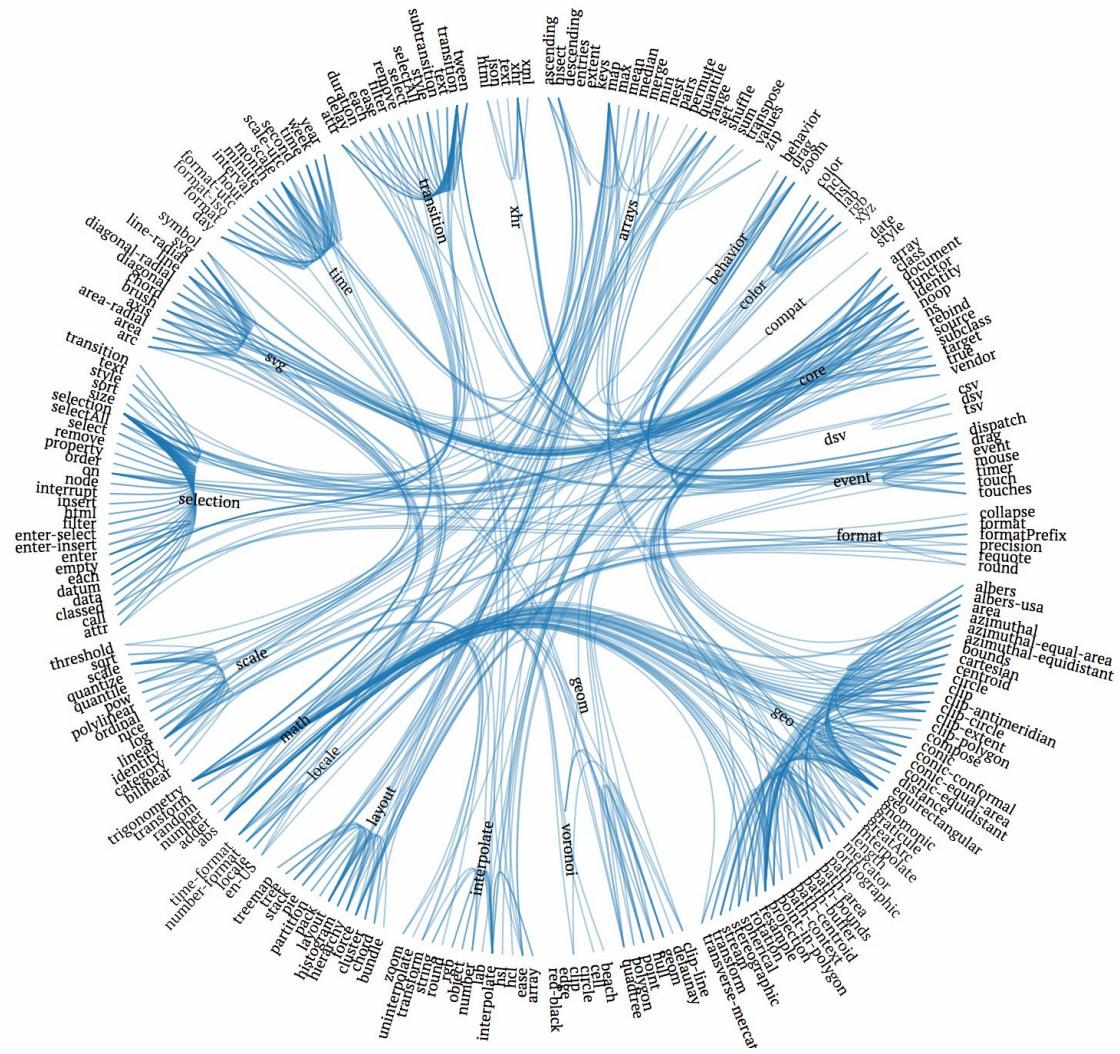
Ex: now using a flat name space

```
var x = d3.scale.linear().range([0, 500]).domain([0, data.length]);  
  
var y = d3.scale.linear().range([0, 100]).domain([0, d3.max(data)]);
```

```
var x = d3.scaleLinear().range([0, 500]).domain([0, data.length]);  
  
var y = d3.scaleLinear().range([0, 100]).domain([0, d3.max(data)]);
```

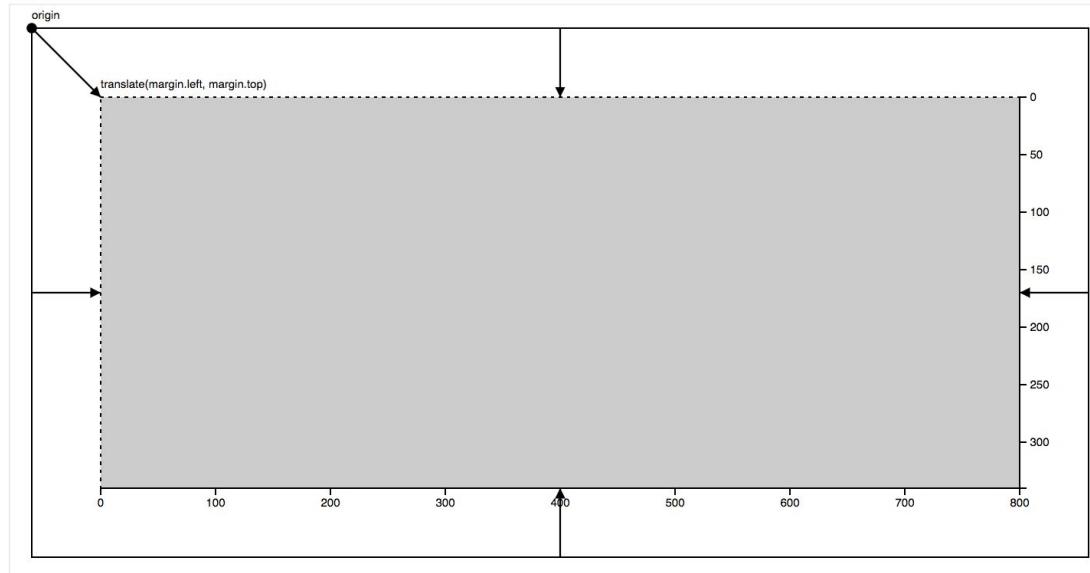






# D3.js principe de base (Page layout)

Margin convention <https://bl.ocks.org/mbostock/3019563>



# D3.js principe de base (DOM inspection)

<https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference>

The screenshot shows the Mozilla Developer Network DOM Inspector interface. A tooltip for the 'HierarchicalCluster' element is displayed, containing options like 'Look Up', 'Copy', 'Search Google', 'Print...', and 'Save to Zotero'. The DOM tree below shows several nested `<g>` elements, each with a transform attribute. One node is highlighted with a red border, and its properties are shown in the bottom right pane, including `_data_`, `co`, `data`, `depth`, `height`, `parent`, `value`, `x0`, `x1`, `y0`, `y1`, `_proto_`, and references to `SVGRectElement`, `SVGGeometryElement`, and `SVGGraphicsElement`. The top navigation bar includes tabs for Elements, Memory, Sources, Network, Security, and Performance.

```
<g transform="translate(413, 161)">...</g>
<g transform="translate(310, 209)">...</g>
<g transform="translate(310, 306)">...</g>
<g transform="translate(336, 209)">...</g>
<g transform="translate(336, 274)">...</g>
<g transform="translate(336, 338)">
  <rect id="flare.util.Sort" width="38" height="63" fill="rgb(201, 202, 78)">...</rect> == $0
  <clipPath id="clip-flare.util.Sort">...</clipPath>
  <text clip-path="url(#clip-flare.util.Sort)">...</text>
  <title>flare.util.Sort 6,887</title>
</g>
<g transform="translate(375, 209)">...</g>
<g transform="translate(420, 209)">...</g>
<g transform="translate(375, 264)">...</g>
<g transform="translate(375, 333)">...</g>
<g transform="translate(411, 264)">...</g>
<g transform="translate(411, 310)">...</g>
<g transform="translate(411, 356)">...</g>
<g transform="translate(465, 61)">...</g>
```

Elements    Memory    Sources    Network    Security    Performance

Look Up "HierarchicalCluster"

Copy

Search Google for "HierarchicalCluster"

Print...

Save to Zotero

Inspect

Speech

Add to iTunes as a Spoken Track

`_data_`: co  
  `data`: {name: "Sort", size: 6887, id: "flare.util.Sort"}  
  `depth`: 2  
  `height`: 0  
  `parent`: co {data: {...}, height: 2, depth: 1, parent: co, children: ...}  
  `value`: 1  
  `x0`: 336  
  `x1`: 374  
  `y0`: 338  
  `y1`: 401  
  `_proto_`: Object  
  `_proto_`: SVGRectElement  
  `SVGRectElement`  
  `SVGGeometryElement`  
  `SVGGraphicsElement`

<https://bl.ocks.org/mbostock/4063582>

# D3.js principe de base (Transitions)

<https://bostocks.org/mike/transition/>

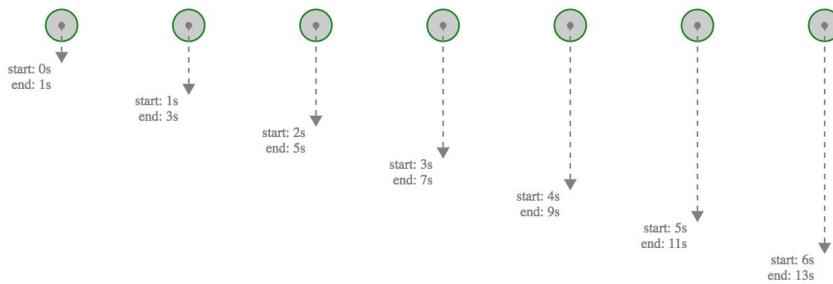
## D3.selectAll(...).transition() Explained

```
○ start
○ d3.selectAll("circle")
○ .transition()
○ .attr("delay", func(d,i){return 1000*i})
○ .attr("duration", func(d,i){return 1000*(i+1)})
○ .attr("cy", func(d,i){return 30*(i+1)})
○ end
```

selectAll(...).transition() schedules \* SEVERAL transitions

As explained in [Transitions Are per-Element and Exclusive](#), `selectAll(...).transition()` schedules 1 transition per selected element. This example schedules 7 transitions, one per circle. Each transition has its own `delay`, `duration`, and end value of the `cy` attribute. `delay` and `duration` allows to derive the start time and the end time of a transition.

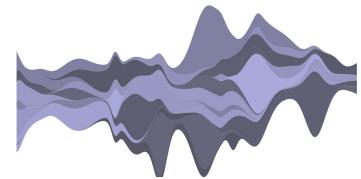
\* In the D3 world, *scheduling* a transition means *defining* a transition, ie. setting its properties.



<http://bl.ocks.org/Kcnarf/9e4813ba03ef34beac6e>

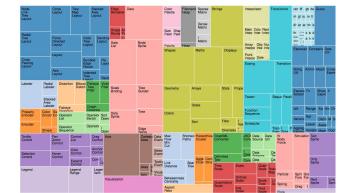
# D3.js principe de base (Advanced)

Axes! (bar chart) <https://bost.ocks.org/mike/bar/3/>



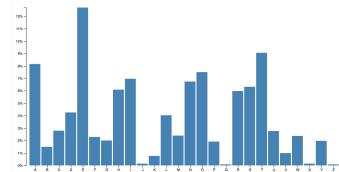
Complex layouts

Streamgraph <https://bl.ocks.org/mbostock/4060954>



Treemap <https://bl.ocks.org/mbostock/4063582>

Transitions (show reel) <https://bl.ocks.org/mbostock/1256572>



Geo maps <https://bost.ocks.org/mike/example/>

Utilisation avec canvas (bar chart) <http://blockbuilder.org/mbostock/946ddf8a32b3b660ffd8>

# Basic D3.js how-to

Hello World // 3 little circles

<https://bostocks.org/mike/circles/>

Introduction à D3.js (Vadim Ogievetsky, co-créateur de D3.js) :

<http://vadim.ogievetsky.com/IntroD3/#1>

Ressources en ligne par Lynn Cherny

<https://github.com/arnicas/d3-faq>

<https://github.com/arnicas/interactive-vis-course>

# Let's make a bar chart



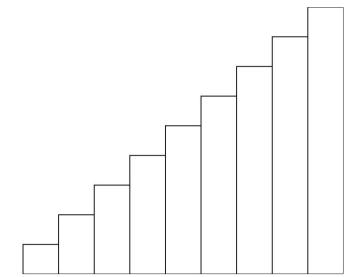
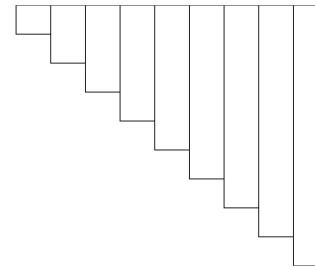
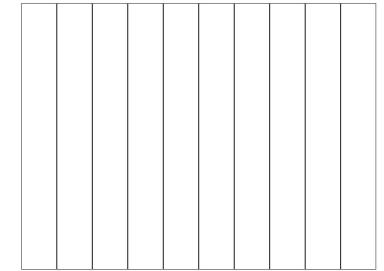
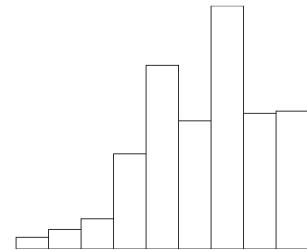
# Visual mapping of a bar chart

Layout: Vertical grid

Rectangle

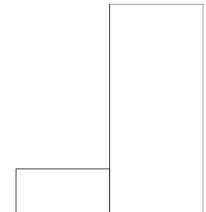
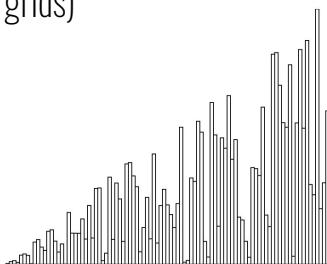
Height

Position



<http://blockbuilder.org/romsson/00733297a7d852d377301d55ed8a4226> (using grids)

!!! Proportion/aspect ratio



# Pure SVG bar chart

```
<svg width="960" height="500">  
  <rect y="178" x="50" width="50" height="22"></rect>  
  <rect y="168" x="100" width="50" height="32"></rect>  
  <rect y="179" x="150" width="50" height="21"></rect>  
  <rect y="177" x="200" width="50" height="23"></rect>  
  <rect y="190" x="250" width="50" height="10"></rect>  
  <rect y="178" x="300" width="50" height="22"></rect>  
  <rect y="189" x="350" width="50" height="11"></rect>  
  <rect y="181" x="400" width="50" height="19"></rect>  
  <rect y="170" x="450" width="50" height="30"></rect>  
  <rect y="150" x="500" width="50" height="50"></rect>  
</svg>
```



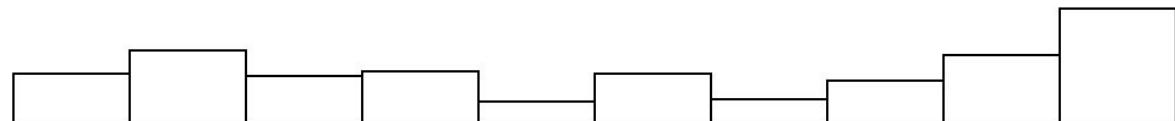
<http://blockbuilder.org/romsson/36b1cdc599e8f341a33892f143cf087f>

# D3 bar chart without data binding

```
var svg = d3.select("body").append("svg")
  .attr("width", 960)
  .attr("height", 500)

var data = [22, 32, 21, 23, 10, 22, 11, 19, 30, 50];

data.map(function(d, i) {
  svg.append("rect")
    .attr("y", 200 - d)
    .attr("x", 50 + (i * 5)
    .attr("width", 50)
    .attr("height", d);
});;
```



<http://blockbuilder.org/romsson/f4baa95d363ee21d0952ca561cd2a0e5>

# D3 bar chart *with* data binding

```
var svg = d3.select("body").append("svg")
  .attr("width", 960)
  .attr("height", 500)

var data = [22, 32, 21, 23, 10, 22, 11, 19, 30, 50];

data.map(function(d, i) {
  svg.append("rect")
    .attr("y", 200 - d)
    .attr("x", 50 + (i * 5)
    .attr("width", 50)
    .attr("height", d);
});;
```



# D3 bar chart *with* data binding and scales *from* dataset

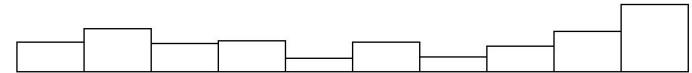
```
// No domain (yet!)
var x = d3.scale.linear().range([0, 500]);
var y = d3.scale.linear().range([0, 100])

var g = svg.append("g").attr("transform", "translate(100, 0)");

d3.csv(";"+"dataset.csv", function(data) {

    // Domain after data have been loaded!
    x.domain([0, data.length]);

    // Accessor for value
    y.domain([0, d3.max(data, function(d) { return d.value; })]);
});
```

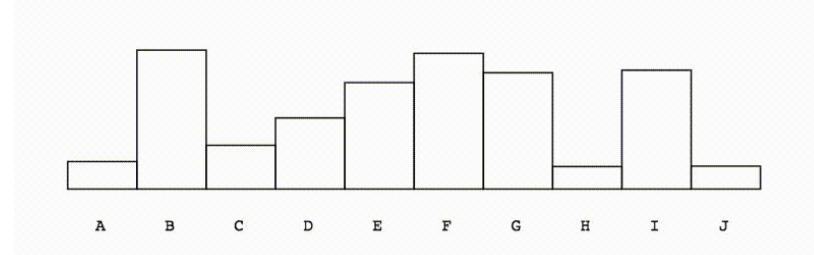


Where is the dataset???????

<http://blockbuilder.org/romsson/66505e5ae61b0908ee857ecf54e508d9>

# D3 bar chart *with* animation

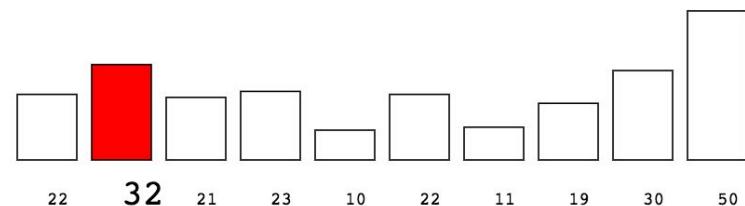
```
setInterval(function(d) {  
  
    data.forEach(function(d) {  
        d.value = Math.random();  
    });  
  
    y.domain([0, d3.max(data, function(d) { return d.value; })]);  
  
    g.selectAll("rect").data(data).transition()  
        .attr("y", function(d) { return 170 - y(d.value); })  
        .attr("height", function(d) { return  
}, 500)
```



<http://blockbuilder.org/romsson/98c007fd3367cd0665ebd15299c3bfdc>

# D3 bar chart *with* interaction

```
g.selectAll("rect").data(data).enter().append("rect")
  .attr("x", function(d, i) { return x(i); })
  .attr("y", function(d) { return 170 - y(d); })
  .attr("height", function(d) { return y(d); })
  .attr("width", 500 / data.length - 10 )
  .on("mouseover", function(d) {
    d3.select(this).style("fill", "red");
    // Should be using Ids instead of values
    d3.selectAll("text").filter(function(e) {
      return d === e;
    })
    .style("font-size", 24);
  })
  .on("mouseout", function(d) {
    d3.select(this).transition().duration(500).style("fill", "white");
    // Should be using Ids instead of values
    d3.selectAll("text").filter(function(e) {
      return d === e;
    })
  })
  .transition().duration(500)
  .style("font-size", 12);
});
```



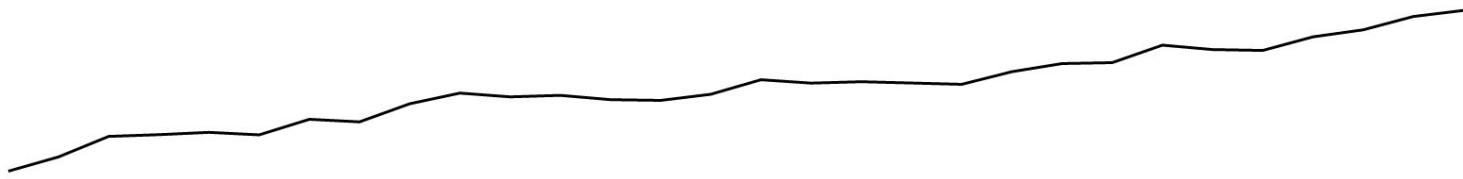
<http://blockbuilder.org/romsson/c607174fc6fd5c7bfaa804d46ca70eab>

# D3 bar chart *responsive* to web page

```
var width = window.innerWidth,  
    height = window.innerHeight;  
  
d3.select(window).on('resize', resize);  
  
function resize() {  
  
    // Update  
  
}
```

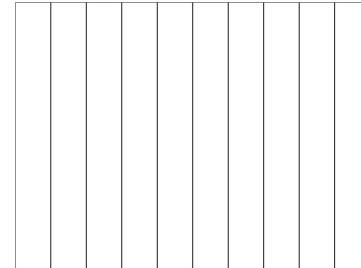
*No link because not working with blockbuilder (fixed width)!*

# Let's make a line chart



# Visual mapping of a line chart

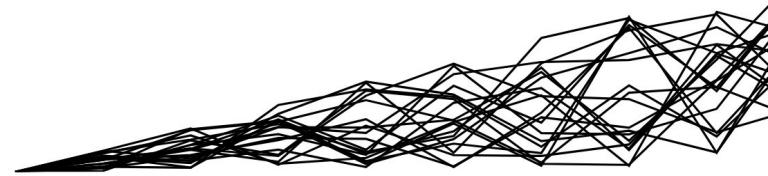
Layout: Vertical grid



Mark: Line

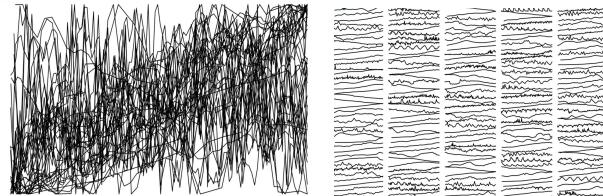
Property: Height

Property: Position



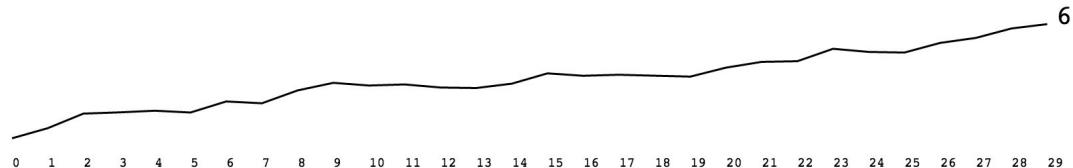
<http://blockbuilder.org/romsson/a801f6359447802c43b2f322885fbf67>

!!! Proportion/aspect ratio/number of elements



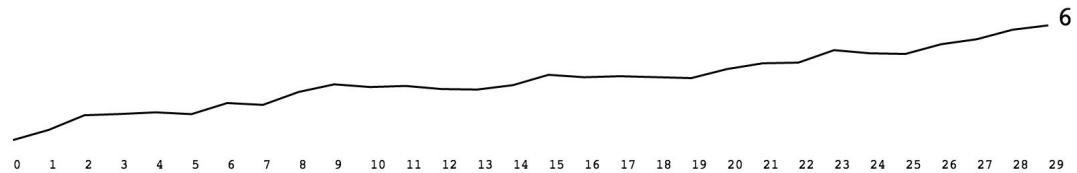
# Simple line chart using SVG

```
<svg width="960" height="500">
  <path class="line" d="M56,360L162,280L268,320L374,240L480,200L586,320L692,360"></path>
  <text y="420" x="56" style="font-size: 10px; font-family: monospace;">Jan 16</text>
  <text y="420" x="162" style="font-size: 10px; font-family: monospace;">Feb 16</text>
  . . .
</svg>
```



<http://blockbuilder.org/romsson/855207ac5fb5c170de59b9c69ea56012>

# Simple line chart with d3js



<http://blockbuilder.org/romsson/855207ac5fb5c170de59b9c69ea56012>

# Interactive line chart with d3js

Regular line chart

Dots for each data point

Vertical line

Time axis

