



D3.js Avancé / Time Visualization

Cours #3

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

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OUTLINE

SOLUTION: INTERACTIVE LINE CHART

TIME VISUALIZATION

ADVANCED D3.JS

TIME VISUALIZATION

what is time?

Passé, présent et futur

Unidirectionnel

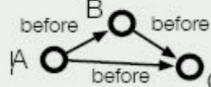
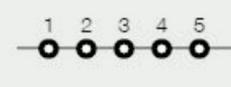
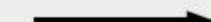
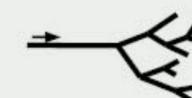
Permet la séquence d'événements

Permet de mesurer la durée d'événements

Permet de comparer des mesures aux mêmes instants

Exemples de données temporelles (dont la composante principale est le temps) : calendrier, climat, etc.

TIME VISUALIZATION

scale	 ordinal	 discrete	 continuous
scope	 point-based	 interval-based	
arrangement	 linear	 cyclic	
viewpoint	 ordered	 branching	 multiple perspectives

TIME VISUALIZATION: TASKS!



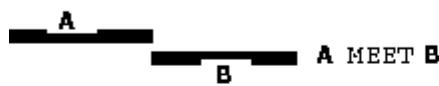
A EQUAL B



A BEFORE B



A iBEFORE B



A MEET B



A iMEET B



A OVERLAP B



A iOVERLAP B



A DURING B



A iDURING B



A START B



A iSTART B

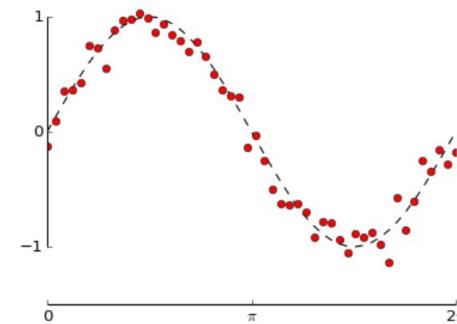
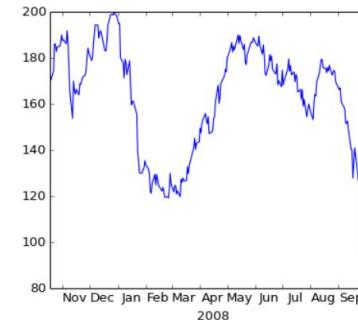
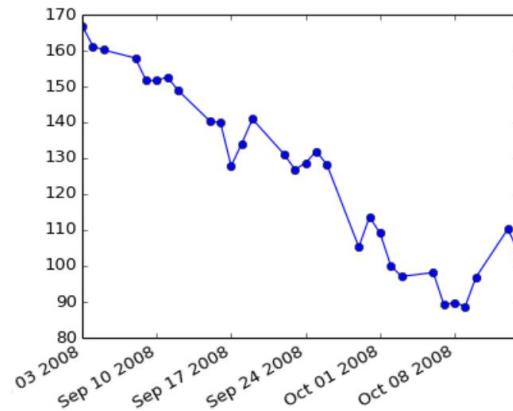
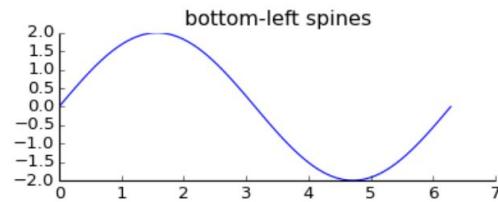


A FINISH B



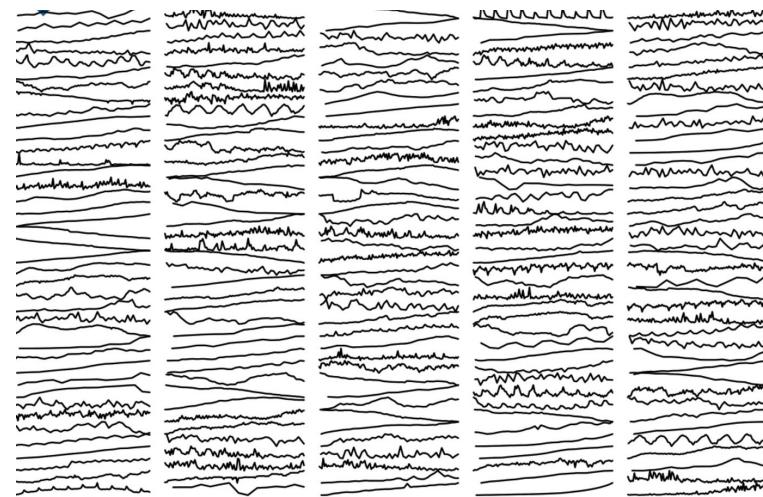
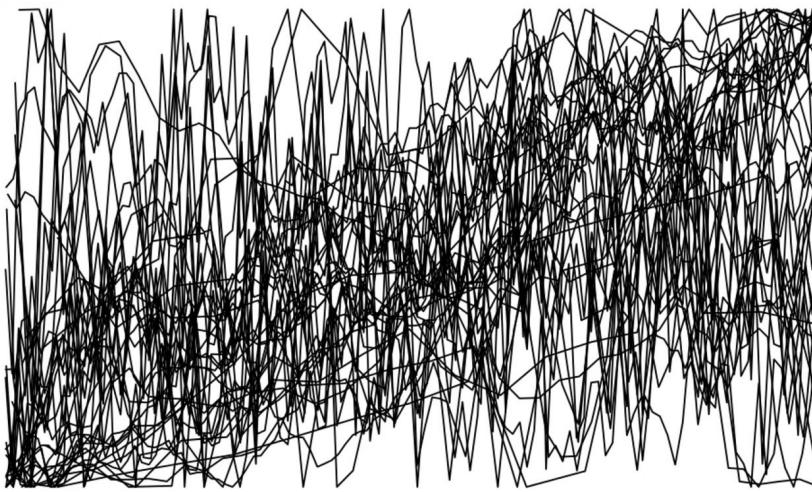
A iFINISH B

TIME VISUALIZATION

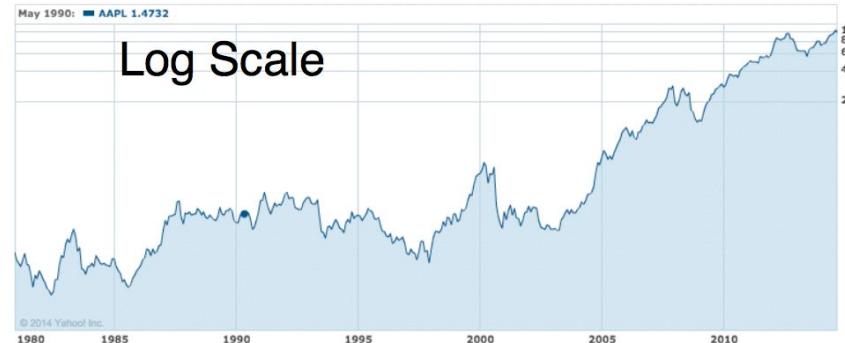
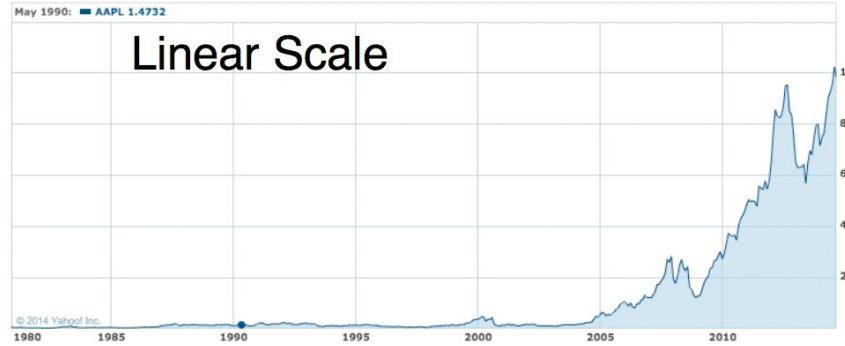


matplotlib gallery

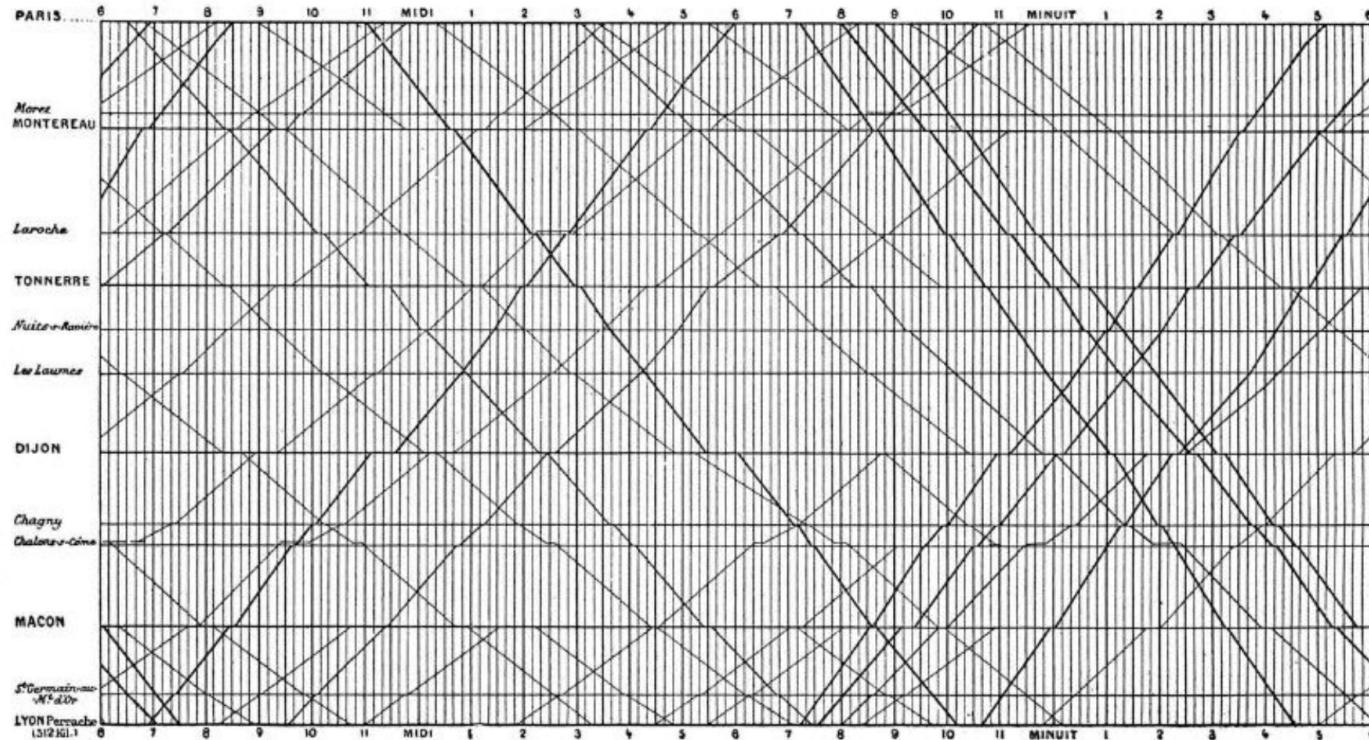
TIME VISUALIZATION



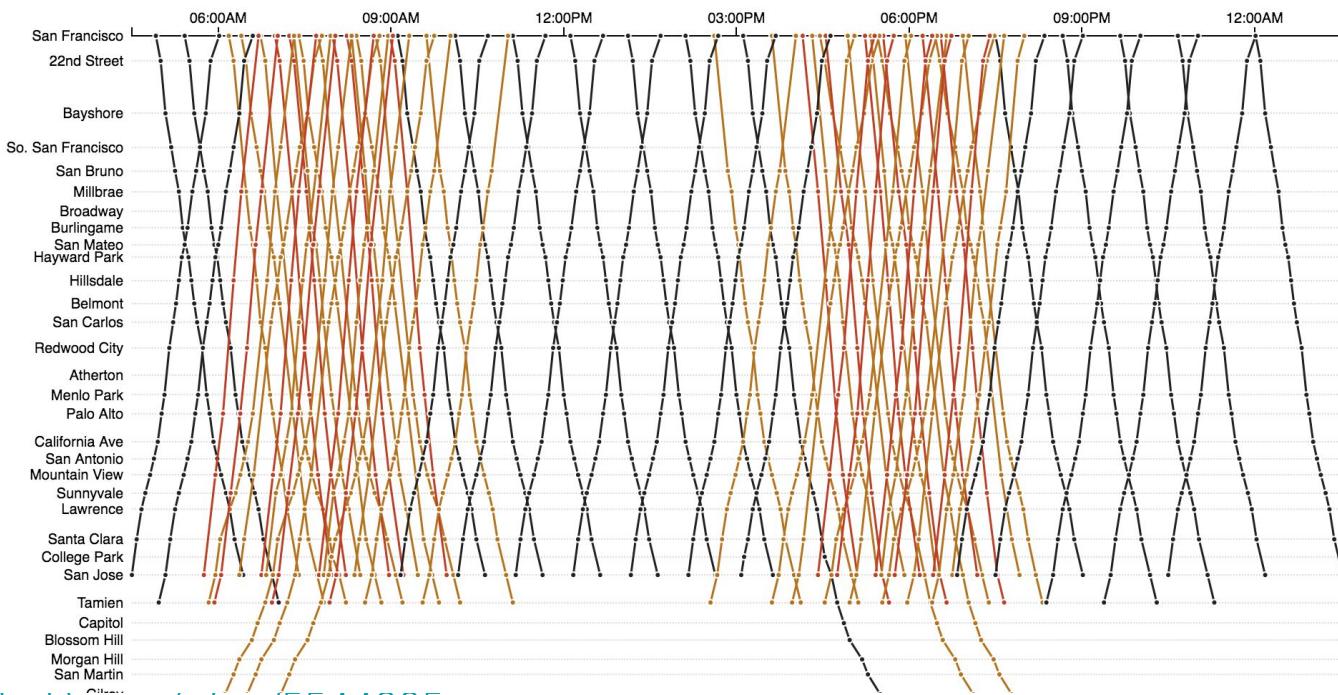
TIME VISUALIZATION



Marey Timeline



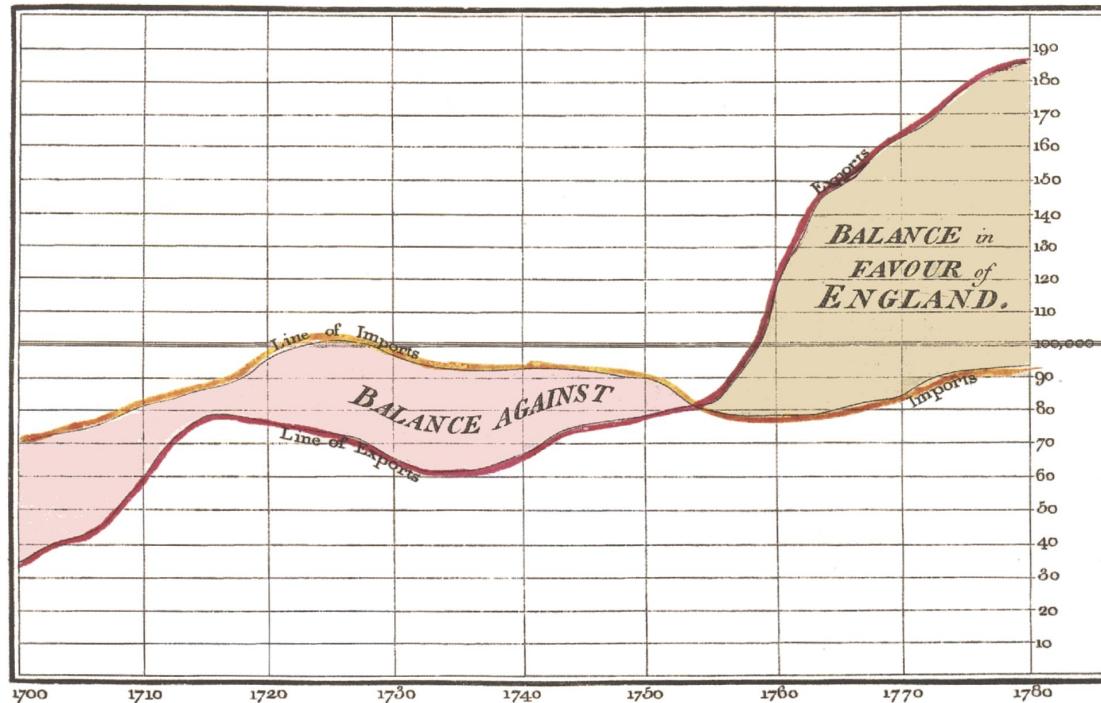
Marey Timeline



<http://blockbuilder.org/johan/5544395>

TIME VISUALIZATION

Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780.

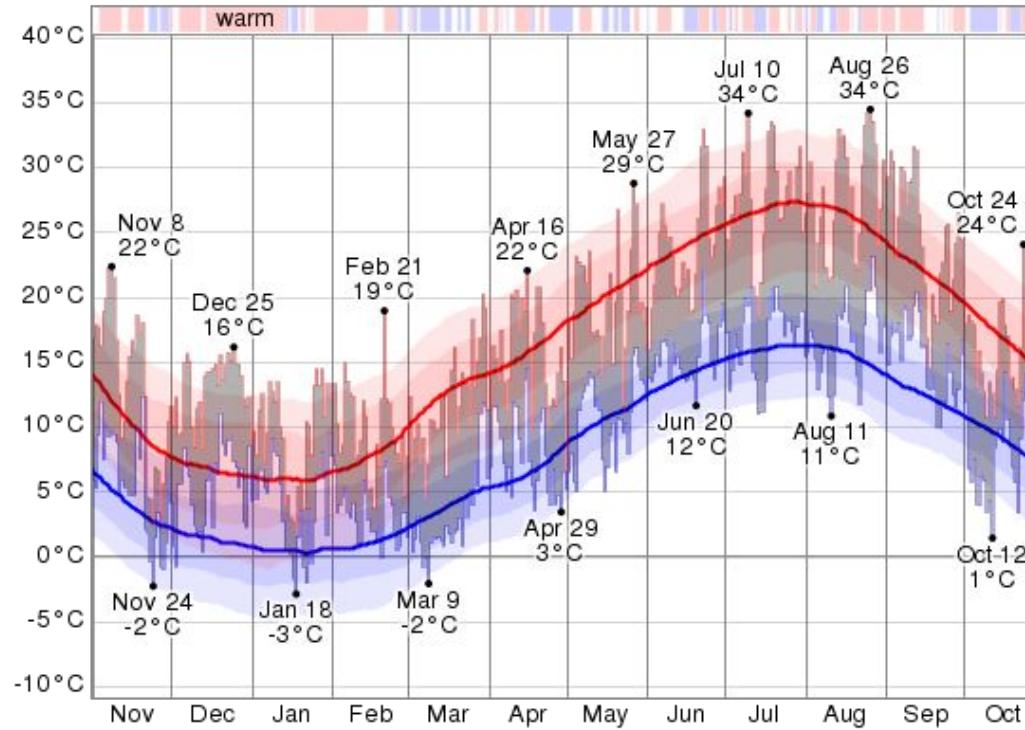


The Bottom line is divided into Years, the Right hand line into £10,000 each.
Published as the Act directs, 1st May 1786, by W^m Playfair
Neale, sculpt 352, Strand, London.

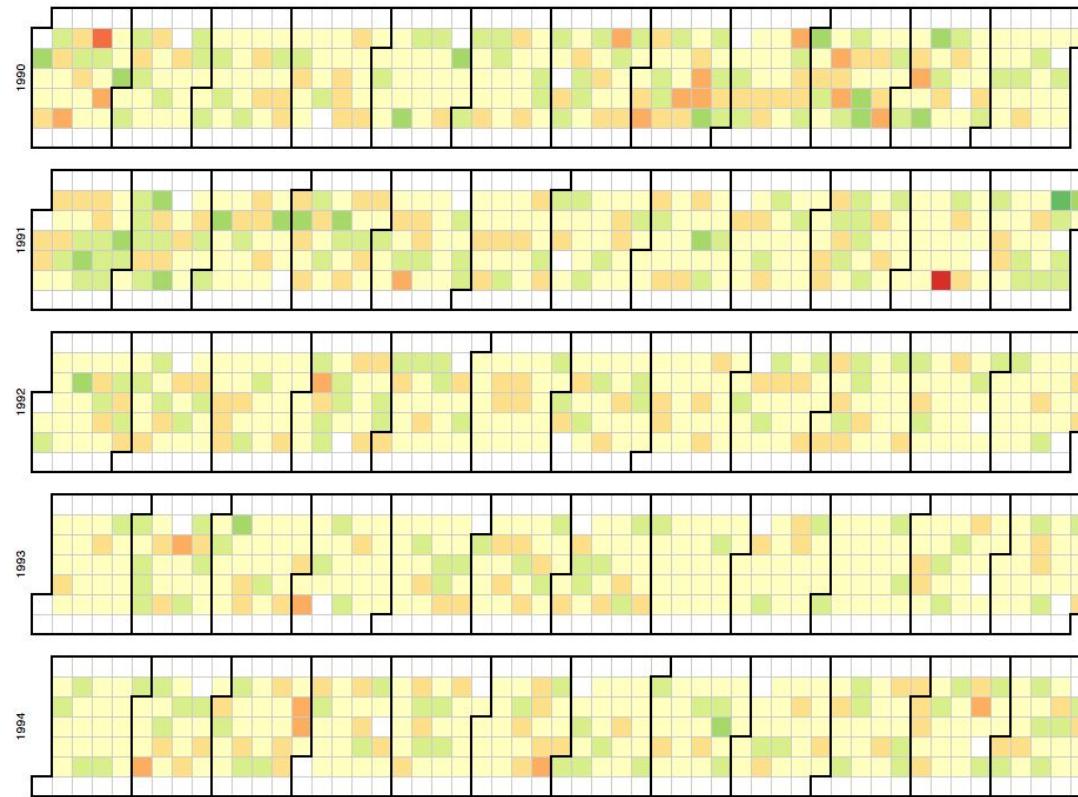
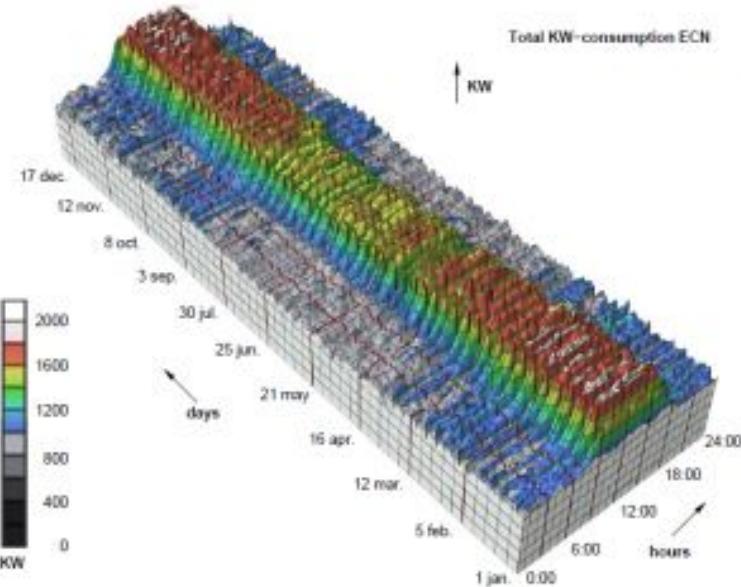
TIME VISUALIZATION



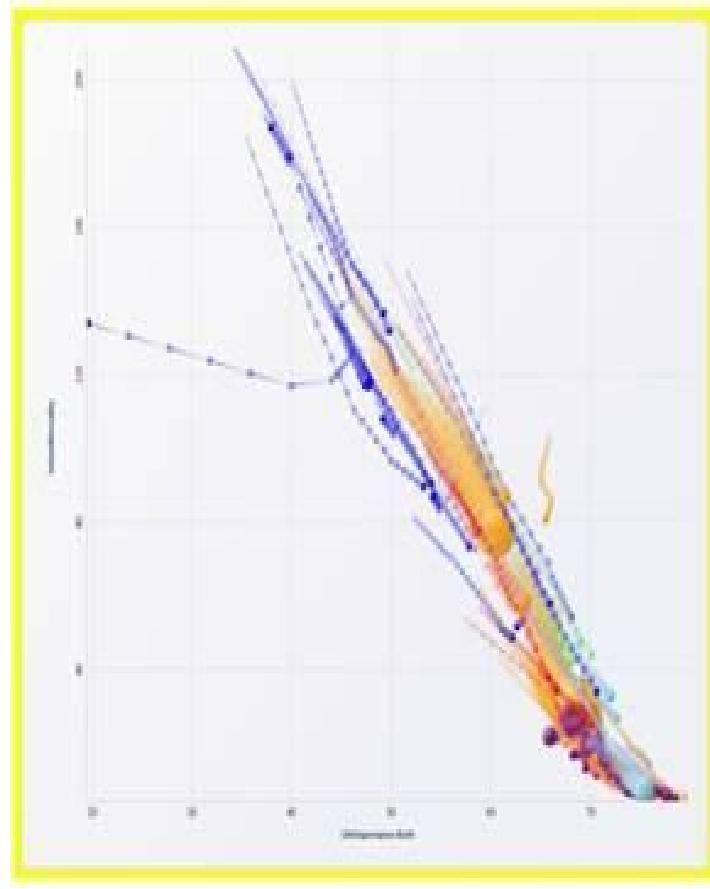
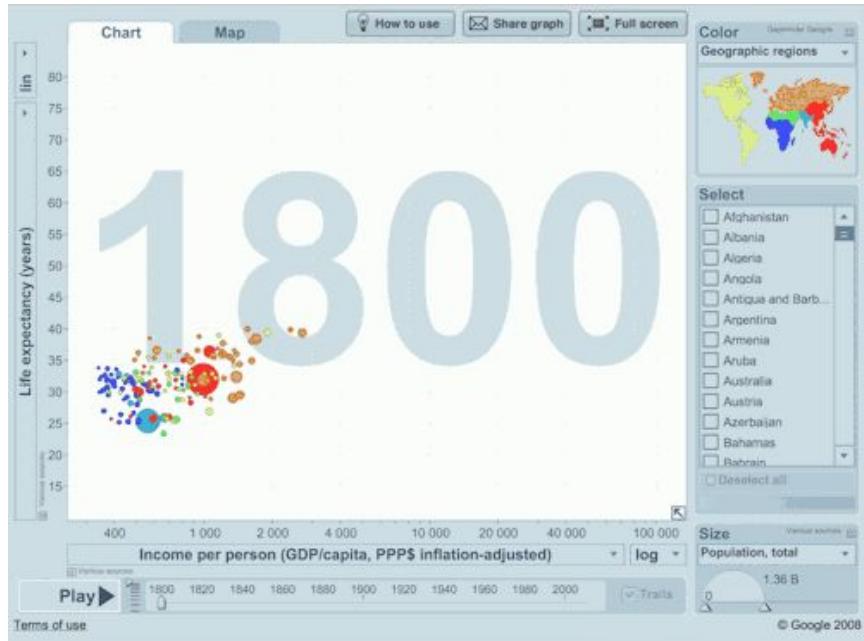
TIME VISUALIZATION



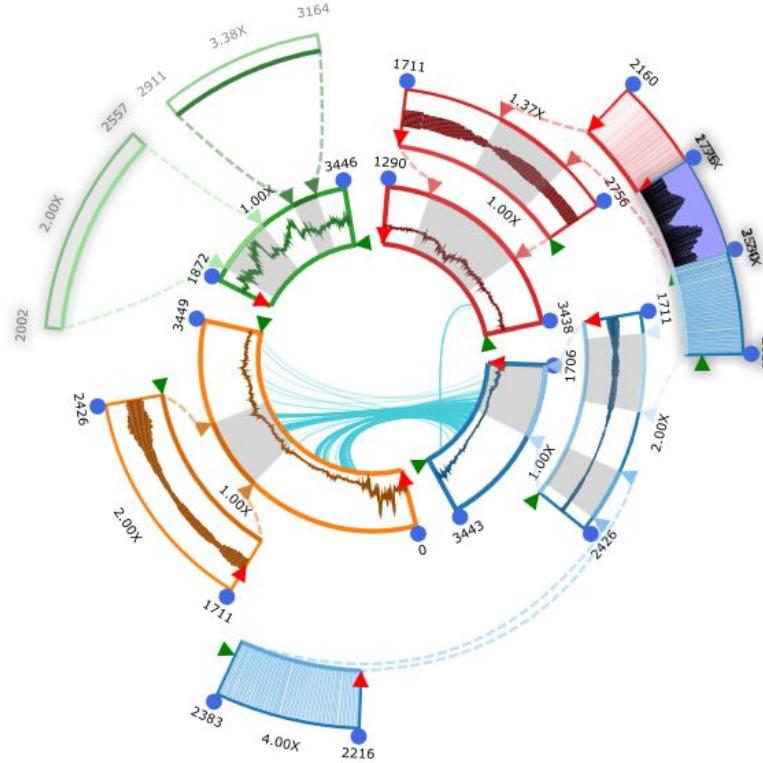
TIME VISUALIZATION: 3D & CALENDAR MAP



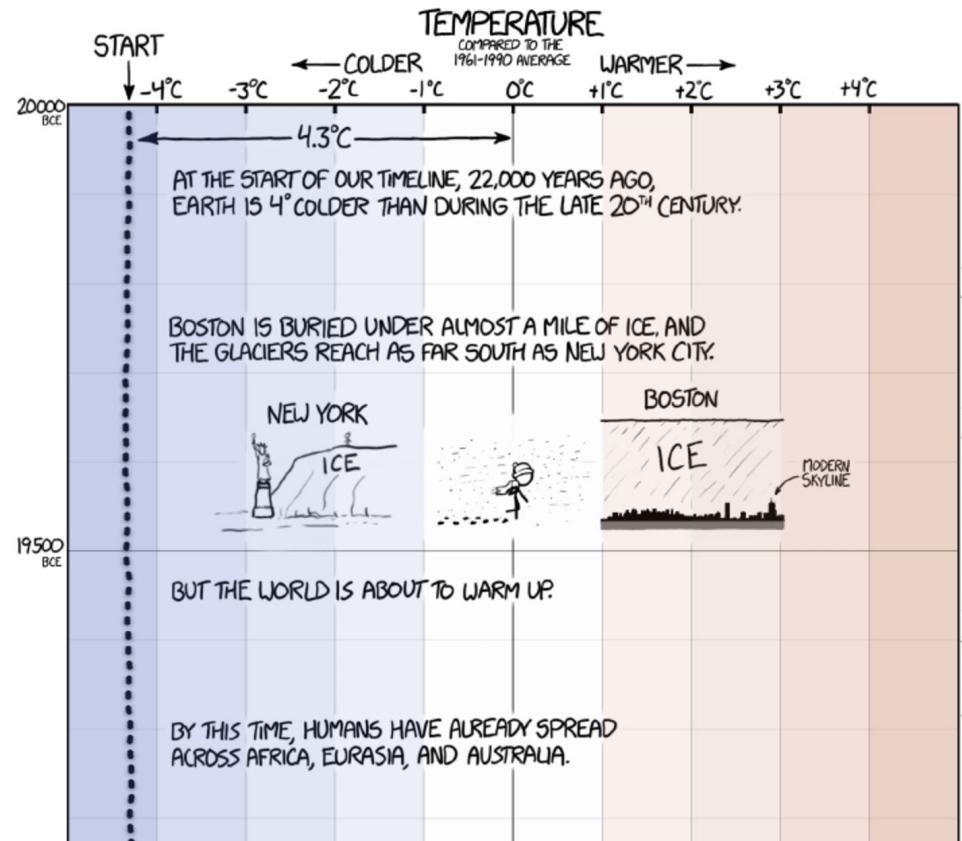
TIME VISUALIZATION: ANIMATION



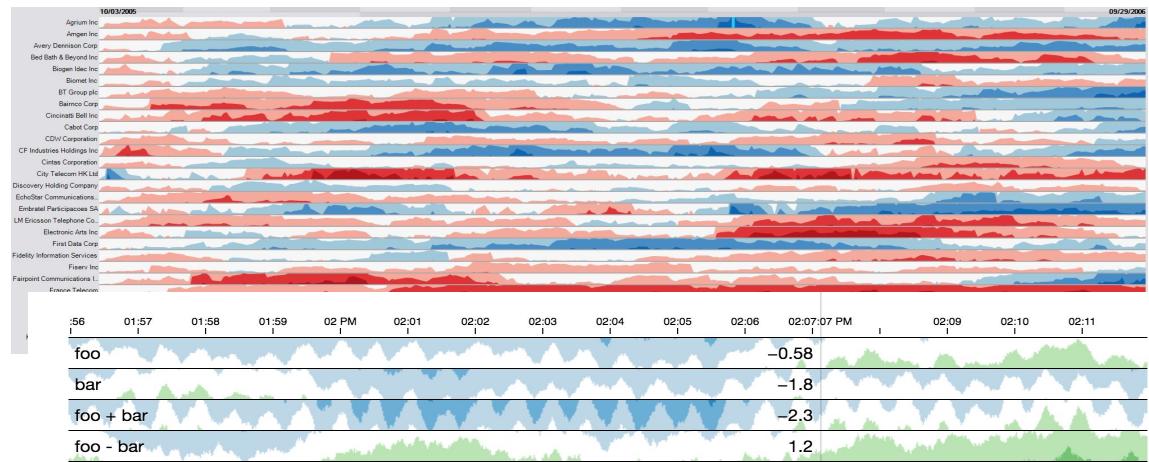
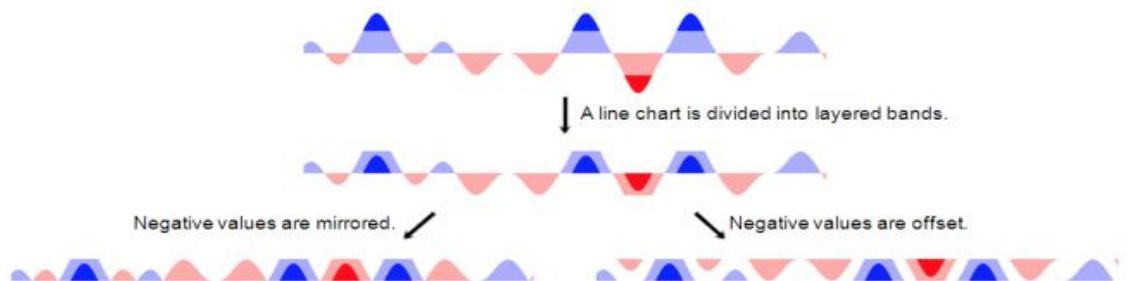
TIME VISUALIZATION: CYCLIC



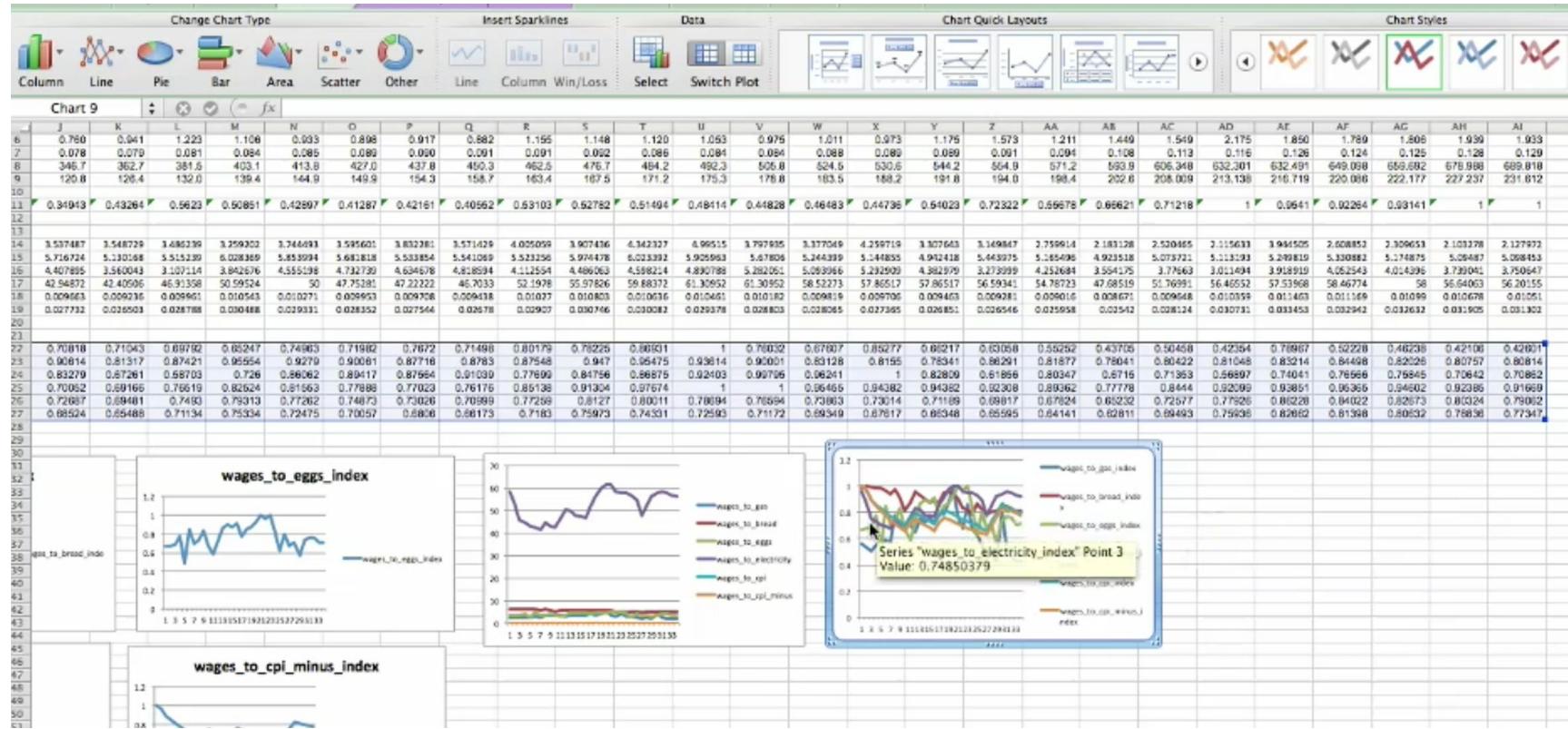
TIME VISUALIZATION: SCALE



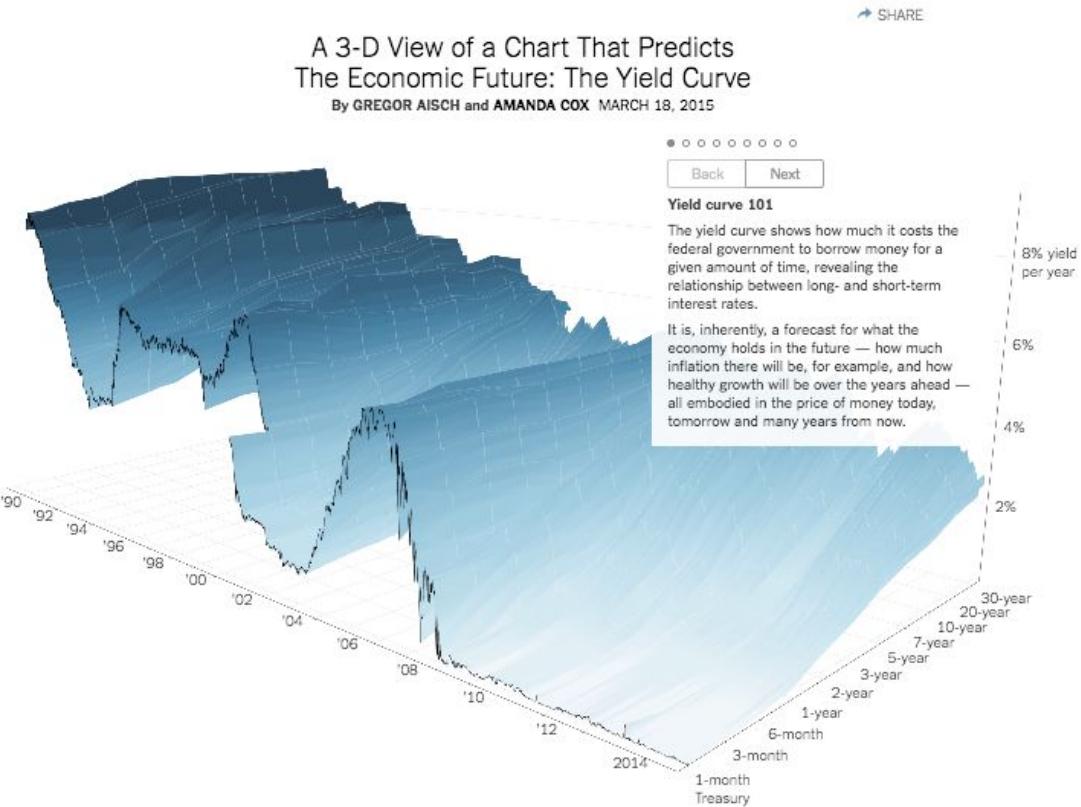
TIME VISUALIZATION: HORIZON GRAPH



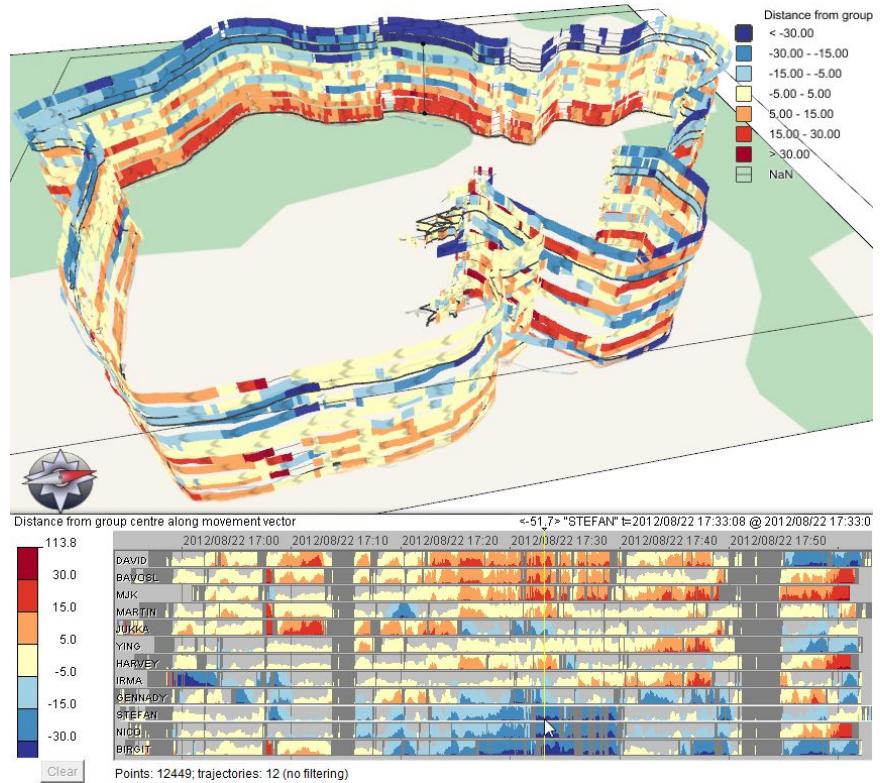
TIME VISUALIZATION: DERIVED DATA



TIME VISUALIZATION: LARGE SCALE



TIME VISUALIZATION: SPACE & TIME



GEO-MAP: GRID



Advanced D3

d3.nest

```
var expenses =  
[{"name":"jim","amount":34,"date":"11/12/2015"},  
 {"name":"carl","amount":120.11,"date":"11/12/2015"},  
 {"name":"jim","amount":45,"date":"12/01/2015"},  
 {"name":"stacy","amount":12.00,"date":"01/04/2016"},  
 {"name":"stacy","amount":34.10,"date":"01/04/2016"},  
 {"name":"stacy","amount":44.80,"date":"01/05/2016"}  
];
```

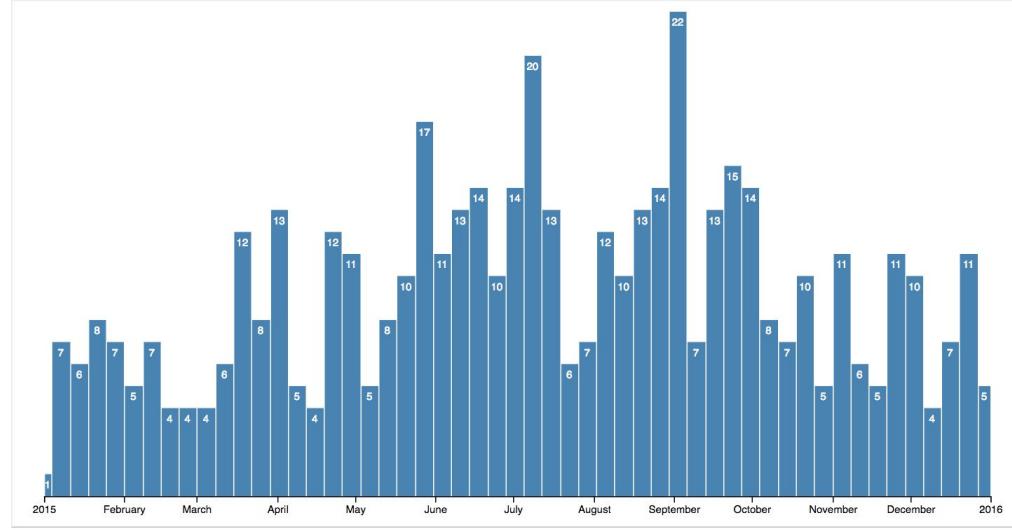
```
var expensesByName = d3.nest()  
  .key(function(d) { return d.name; })  
  .entries(expenses);
```



```
expensesByName = [  
  {"key":"jim","values": [  
    {"name":"jim","amount":34,"date":"11/12/2015"},  
    {"name":"jim","amount":45,"date":"12/01/2015"}  
  ]},  
  {"key":"carl","values": [  
    {"name":"carl","amount":120.11,"date":"11/12/2015"}  
  ]},  
  {"key":"stacy","values": [  
    {"name":"stacy","amount":12.00,"date":"01/04/2016"},  
    {"name":"stacy","amount":34.10,"date":"01/04/2016"},  
    {"name":"stacy","amount":44.80,"date":"01/05/2016"}  
  ]}]
```

Histogram

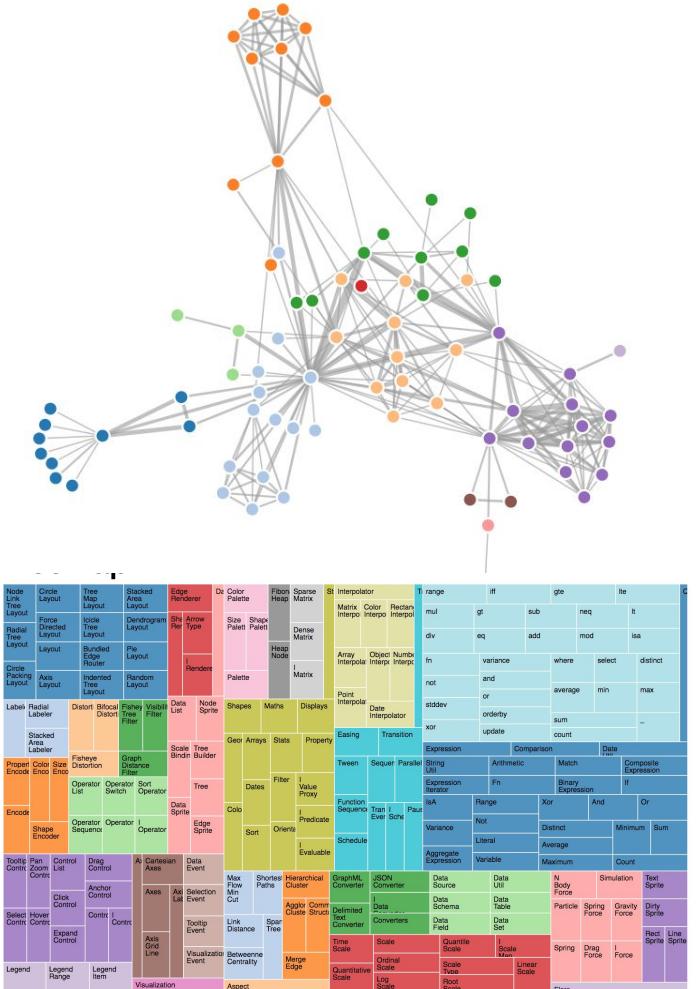
```
var histogram = d3.histogram()  
  .value(function(d) { return d.date; })  
  .domain(x.domain())  
  .thresholds(x.ticks(d3.timeWeek));  
  
var bins = histogram(data);  
  
y.domain([0, d3.max(bins, function(d) { return d.length; })]);  
  
var bar = svg.selectAll(".bar")  
  .data(bins)  
  .enter().append("g")  
  .attr("class", "bar")  
  .attr("transform", function(d) { return "translate(" + x(d.x0) + "," + y(d.length) + ")"; });  
  
bar.append("rect")  
  .attr("x", 1)  
  .attr("width", function(d) { return x(d.x1) - x(d.x0) - 1; })  
  .attr("height", function(d) { return height - y(d.length); });  
  
bar.append("text")  
  .attr("dy", ".75em")  
  .attr("y", 6)  
  .attr("x", function(d) { return (x(d.x1) - x(d.x0)) / 2; })  
  .attr("text-anchor", "middle")  
  .text(function(d) { return formatCount(d.length); });
```



<https://bl.ocks.org/mbostock/b2fee5dae98555cf78c9e4c5074b87c3>

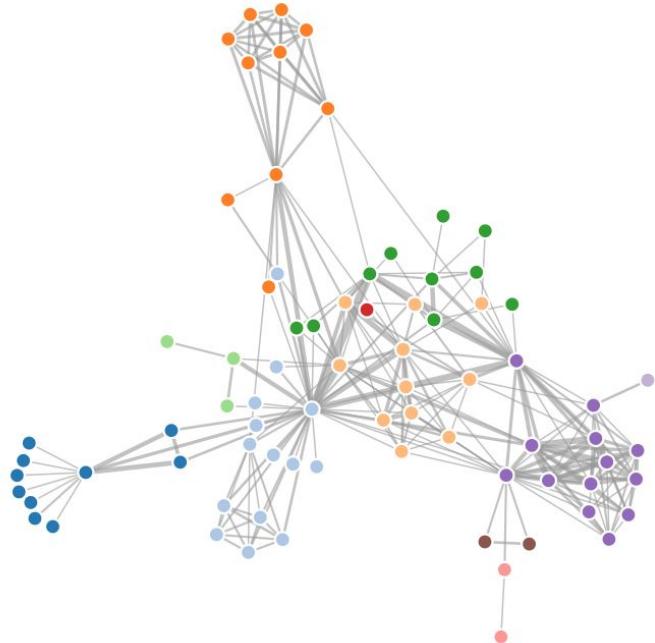
Node-link Graph & Treemap

```
{
  "nodes": [
    {"id": "Myriel", "group": 1},
    {"id": "Napoleon", "group": 1},
    {"id": "Mlle.Baptistine", "group": 1},
    {"id": "Mme.Magloire", "group": 1},
    {"id": "CountessdeLo", "group": 1},
    {"id": "Mme.Hucheloup", "group": 8}
  ],
  "links": [
    {"source": "Napoleon", "target": "Myriel", "value": 1},
    {"source": "Mlle.Baptistine", "target": "Myriel", "value": 8},
    {"source": "Mme.Magloire", "target": "Myriel", "value": 10},
    {"source": "Mme.Magloire", "target": "Mlle.Baptistine", "value": 6},
    {"source": "CountessdeLo", "target": "Myriel", "value": 1},
    {"source": "Geborand", "target": "Myriel", "value": 1}
    {"source": "Mme.Hucheloup", "target": "Enjolras", "value": 1}
  ]
}
```



Node-link Graph

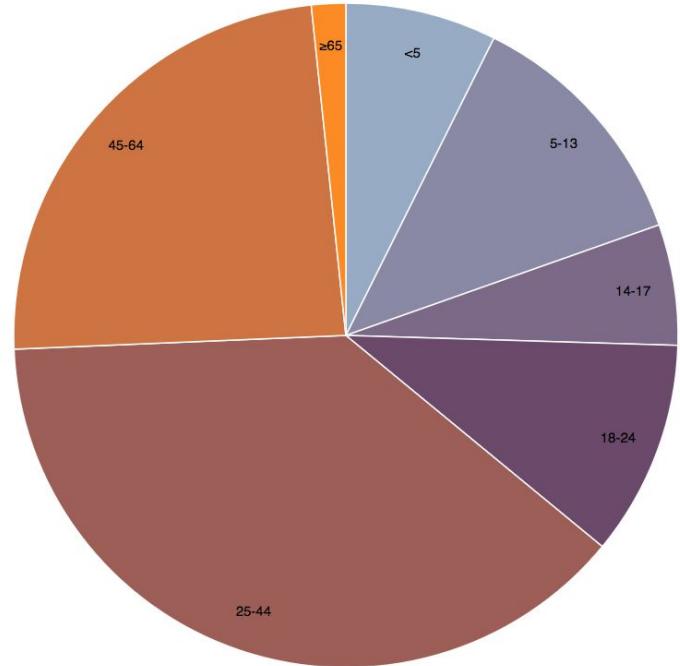
```
function ticked() {  
  link  
    .attr("x1", function(d) { return d.source.x; })  
    .attr("y1", function(d) { return d.source.y; })  
    .attr("x2", function(d) { return d.target.x; })  
    .attr("y2", function(d) { return d.target.y; });  
  
  node  
    .attr("cx", function(d) { return d.x; })  
    .attr("cy", function(d) { return d.y; });  
}  
});
```



Pie Chart

```
var pie = d3.pie()  
  .sort(null)  
  .value(function(d) { return d.population; });  
  
var path = d3.arc()  
  .outerRadius(radius - 10)  
  .innerRadius(0);  
  
var label = d3.arc()  
  .outerRadius(radius - 40)  
  .innerRadius(radius - 40);  
  
d3.csv("data.csv", function(d) {  
  d.population = +d.population;  
  return d;  
}, function(error, data) {  
  if (error) throw error;  
  
  var arc = g.selectAll(".arc")  
    .data(pie(data))  

```

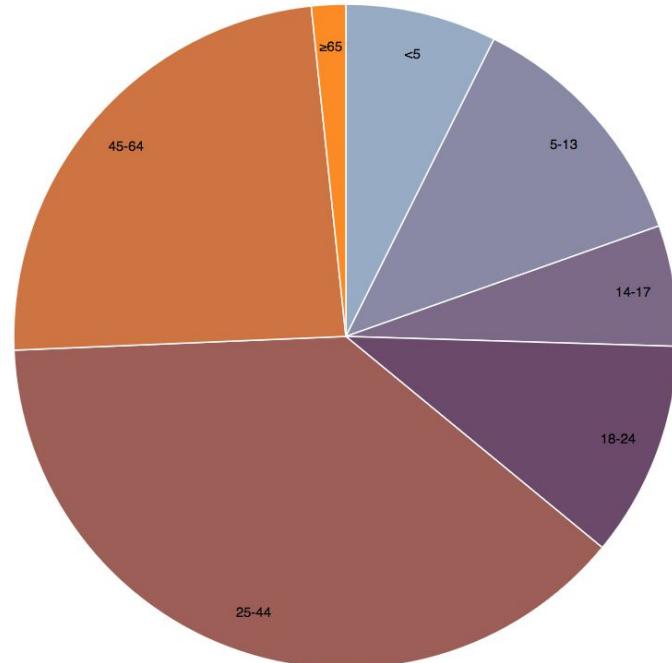


<https://bl.ocks.org/mbostock/3887235>

Pie Chart

```
var arc = d3.arc();  
  
arc({  
  innerRadius: 0,  
  outerRadius: 100,  
  startAngle: 0,  
  endAngle: Math.PI / 2  
}); // "M0,-100A100,100,0,0,1,100,0L0,0Z"
```

```
var arc = d3.arc()  
  .innerRadius(0)  
  .outerRadius(100)  
  .startAngle(0)  
  .endAngle(Math.PI / 2);
```



Treemap

```
var treemap = d3.treemap()
  .tile(d3.treemapResquarify)
  .size([width, height])
  .round(true)
  .paddingInner(1);
```

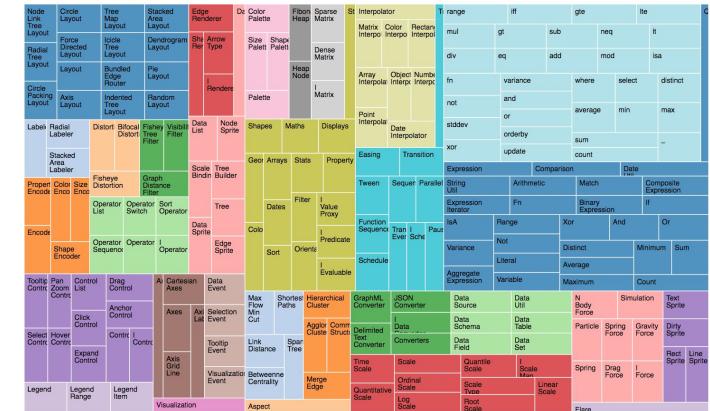
```
var root = d3.hierarchy(data)
  .eachBefore(function(d) { d.data.id = (d.parent ? d.parent.data.id + "." : "") + d.data.name; })
  .sum(sumBySize)
  .sort(function(a, b) { return b.height - a.height || b.value - a.value; });
```

```
treemap(root);
```

```
var cell = svg.selectAll("g")
  .data(root.leaves())
  .enter().append("g")
  .attr("transform", function(d) { return "translate(" + d.x0 + "," + d.y0 + ")"; });

cell.append("rect")
```

```
  .attr("id", function(d) { return d.data.id; })
  .attr("width", function(d) { return d.x1 - d.x0; })
  .attr("height", function(d) { return d.y1 - d.y0; })
  .attr("fill", function(d) { return color(d.parent.data.id); }));
```



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

Treemap

```
var d3Hierarchy = require("d3-hierarchy")
```

```
var treemap = d3Hierarchy.treemap()
  .size([10, 10])
  .padding(10);
```

```
var stratify = d3Hierarchy.stratify()
  .id(function(d) { return d.id; })
  .parentId(function(d) { return d.parent_id;
});
```

```
var root = stratify([{"id": "root", "parent_id": "",
}, {"id": "child", "parent_id": "root"}]);
```

```
var tree = treemap(root);
```

```
tree.leaves()
```

<https://npm.runkit.com/d3-hierarchy>

Code	Color	Font	Image	Interpolate	Matrix	Range	If	Get	Iterate	Group
Node Line Layout	Circle Layout	Tree Map Layout	Stacked Area Layout	Edge Renderer	De Color Palette	Fiber Heap Sparse Matrix	St Interpolator	mul	gt	sub
Radial Tree Layout	Force Directed Layout	Idle Tree Layout	Dendrogram Tree Layout	Sh Arrow Type	Size Shape Pallet	Heaps Matrix	Matrix Interpo	div	eq	neq
Cross Packing Layout	Axis Layout	Bundled Edge Router	Indented Tree Layout	Renderers	Pallet Pallet	Heap Node	Color Interpo	in	and	it
Label Radial Labeler	Stacked Area Labeler	Desert Bifocal Distortion	Fahey Visible Filter	Data List	Node Sprites	I Matrix	Rectangular Interpol	not	or	is
Proper Encode	Color Size Encode	Fahey Detection	Graph Difference Filter	Shapes	Maths	Displays	Point Interpolate	stddev	average	distinct
Encode	List Operator	Operator Sequence	Operator Switch Operator	Tree	Tree Builder	Easing	Date Interpolator	orderby	min	max
Tooltip Context	Control Pan Zoom Context	Control Drag Control	AI Cartesian Areas	Data Events	Amrys Stats	Property	Transition	xor	sum	-
Select Context	Hover Control	Click Control	Axis Axis	Flow Event	Shortest Paths	Filter	Tween	update	count	
Legend	Legend Range	Legend Item	Contour Contour	Selection Event	Hierarchical Cluster	I Value Proxy	Sequen Parallel	Expression	Comparison	Data
			Grid Grid Line	Tooltip Event	Aggri Cluster	Predicate	Schedule	String Fn	Arithmetic	Match
			Visualization Event	Link Distance	Coms Struc	I Evaluate	Train Ever Since	Fn	Binary Expression	Compose Expression
			Between Centrality	Span Tree	Merge Edge	Orients	Paul	isA	Range	If
			Aspect	Time Scale	Defined Text Converter	Time Scale	GraphML Converter	Variance	Not	Or
			Visualization	Quantitative Scale	Text Converters	Scale	JSON Converter	Data Source	District	Minimum
			Aspect	Log Scale	Data Field	Quanite Scale	Data Util	Data Schema	Average	Sum
				Root Scale	Ordinal Scale	Ordinal Scale	Data Table	Data Set	Particle	Text Sprites
					Log Scale	Scale Min	Data Field	Data Set	Spring Force	Gravity
						Linear Scale	Plane	Plane	I Force	Dirty Sprites
									Rect Sprite	Line Sprites

Array (1 item)

0: Node

data: Object {id: "child", parent_id: "root"}

depth: 1

height: 0

id: "child"

parent: Node {children: , data: , depth: 0, height: 1, id: "root", ...}

x0: 5

x1: 5

y0: 10

y1: NaN

Stacked bar chart

```
var keys = data.columns.slice(1);
```

```
g.append("g")
.selectAll("g")
.data(d3.stack().keys(keys)(data))
.enter().append("g")
  .attr("fill", function(d) { return z(d.key); })
.selectAll("rect")
.data(function(d) { return d; })
.enter().append("rect")
  .attr("x", function(d) { return x(d.data.State); })
  .attr("y", function(d) { return y(d[1]); })
  .attr("height", function(d) { return y(d[0]) - y(d[1]); })
  .attr("width", x.bandwidth());
```

State,Under 5 Years,5 to 13 Years,14 to 17 Years,18 to 24 Years,25 to 44 Years,45 to 64 Years,65 Years and Over

AL,310504,552339,259034,450818,1231572,1215966,641667

AK,52083,85640,42153,74257,198724,183159,50277

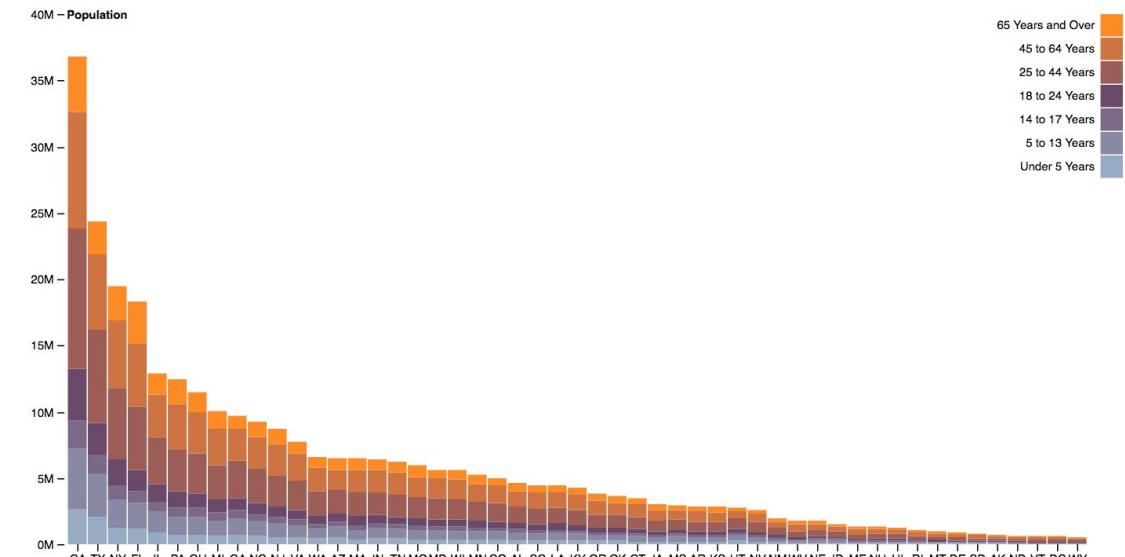
AZ,515910,828669,362642,601943,1804762,1523681,862573

AR,202070,343207,157204,264160,754420,727124,407205

CA,2704659,4499890,2159981,3853788,10604510,8819342,4114496

CO,358280,587154,261701,466194,1464939,1290094,511094

CT,211637,403658,196918,325110,916955,968967,478007



Streamgraph

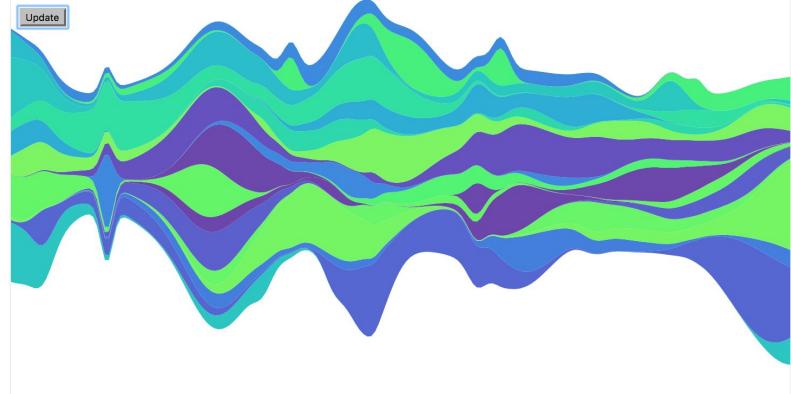
```
var n = 20, // number of layers
m = 200, // number of samples per layer
k = 10; // number of bumps per layer

var stack = d3.stack().keys(d3.range(n)).offset(d3.stackOffsetWiggle),
layers0 = stack(d3.transpose(d3.range(n).map(function() { return bumps(m, k); }))),
layers1 = stack(d3.transpose(d3.range(n).map(function() { return bumps(m, k); }))),
layers = layers0.concat(layers1);

var area = d3.area()
.x(function(d, i) { return x(i); })
.y0(function(d) { return y(d[0]); })
.y1(function(d) { return y(d[1]); });

svg.selectAll("path")
.data(layers0)
.enter().append("path")
.attr("d", area)
.attr("fill", function() { return z(Math.random()); });

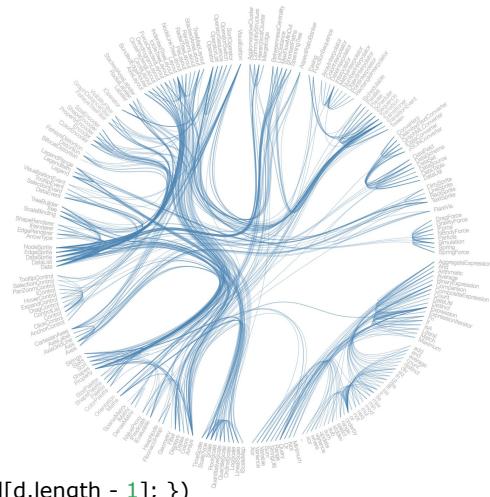

```



Hierarchical Edge Bundling

```
var diameter = 960,  
    radius = diameter / 2,  
    innerRadius = radius - 120;  
  
var cluster = d3.cluster()  
.size([360, innerRadius]);  
  
var line = d3.radialLine()  
.curve(d3.curveBundle.beta(0.85))  
.radius(function(d) { return d.y; })  
.angle(function(d) { return d.x / 180 * Math.PI; });  
  
var svg = d3.select("body").append("svg")  
.attr("width", diameter)  
.attr("height", diameter)  
.append("g")  
.attr("transform", "translate(" + radius + "," + radius + ")");
```

```
var link = svg.append("g").selectAll(".link"),  
node = svg.append("g").selectAll(".node");  
  
var root = packageHierarchy(classes)  
.sum(function(d) { return d.size; });  
  
cluster(root);  
  
link = link  
.data(packageImports(root.leaves()))  
.enter().append("path")  
.each(function(d) { d.source = d[0], d.target = d[d.length - 1]; })  
.attr("class", "link")  
.attr("d", line);  
  
node = node  
.data(root.leaves())  
.enter().append("text")  
.attr("class", "node")  
.attr("dy", "0.31em")  
.attr("transform", function(d) { return "rotate(" + (d.x - 90) + ")translate(" + (d.y + 8) + ",0)"  
+ (d.x < 180 ? "" : "rotate(180)"); })  
.attr("text-anchor", function(d) { return d.x < 180 ? "start" : "end"; })  
.text(function(d) { return d.data.key; })
```



Geomap & Shape files

```
var projection = d3.geo.mercator()  
  .translate([width / 2, height / 2])  
  .scale((width - 1) / 2 / Math.PI);  
  
var path = d3.geo.path()  
  .projection(projection);  
  
d3.json("/mbostock/raw/4090846/world-50m.json", function(error, world) {  
  
  g.append("path")  
    .datum({type: "Sphere"})  
    .attr("class", "sphere")  
    .attr("d", path);  
  
  g.append("path")  
    .datum(topojson.merge(world, world.objects.countries.geometries))  
    .attr("class", "land")  
    .attr("d", path);  
  
  g.append("path")  
    .datum(topojson.mesh(world, world.objects.countries, function(a, b) { return a !== b; }))  
    .attr("class", "boundary")  
    .attr("d", path);  
});
```



<https://bl.ocks.org/mbostock/8fadcc5ac9c2a9e7c5ba2>

Geomap & Shape files

```
{"type": "Topology", "objects": {"countries": {"type": "GeometryCollection", "Bbox": [-180, -89.99892578124998, 180.00000000000003, 83.59960937500006], "geometries": [{"type": "Polygon", "id": 533, "arcs": [[0]]}, {"type": "Polygon", "id": 4, "arcs": [[1, 2, 3, 4, 5, 6, 7]]}, {"type": "MultiPolygon", "id": 24, "arcs": [[[8, 9, 10, 11]], [[12, 13, 14]]]}, {"type": "Polygon", "id": 660, "arcs": [[15]]}, {"type": "Polygon", "id": 8, "arcs": [[16, 17, 18, 19, 20]]}, {"type": "MultiPolygon", "id": 248, "arcs": [[[21]], [[22]], [[23]]]}, {"type": "Polygon", "id": 20, "arcs": [[24, 25]]}, {"type": "MultiPolygon", "id": 784, "arcs": [[[26]], [[27]], [[28]], [[29]], [[30, 31, 32, 33, 34]], [35]]]}, {"type": "MultiPolygon", "id": 32, "arcs": [[[36]], [[37, 38]], [[39]], [[40, 41, 42, 43, 44, 45]]]}, {"type": "MultiPolygon", "id": 51, "arcs": [[[46]], [[47, 48, 49, 50, 51]], [52]]]}, {"type": "Polygon", "id": 16, "arcs": [[53]]}, {"type": "MultiPolygon", "id": 10, "arcs": [[[54]], [[55]], [[56]], [[57]], [[58]], [[59]], [[60]], [[61]], [[62]], [[63]], [[64]], [[65]], [[66]]]}]}
```



<https://bl.ocks.org/mbostock/raw/4090846/world-50m.json>

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>

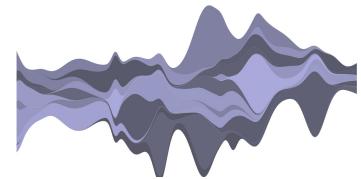
Ressources en ligne par Lynn Cherny

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

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

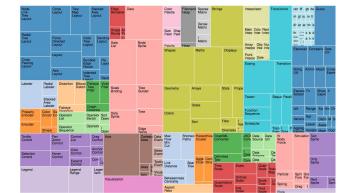
D3.js principe de base (Advanced)

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



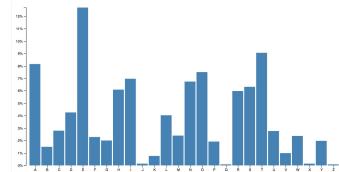
Complex layouts

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>

TP TIME SERIES

Stock market line chart

d3.text - load text data

d3.timeFormat - parse dates

d3.timeScale - x-position encoding

d3.scaleLinear - y-position encoding

d3.schemeCategory10,

d3.scaleOrdinal - color encoding

d3.extent, d3.min and d3.max -

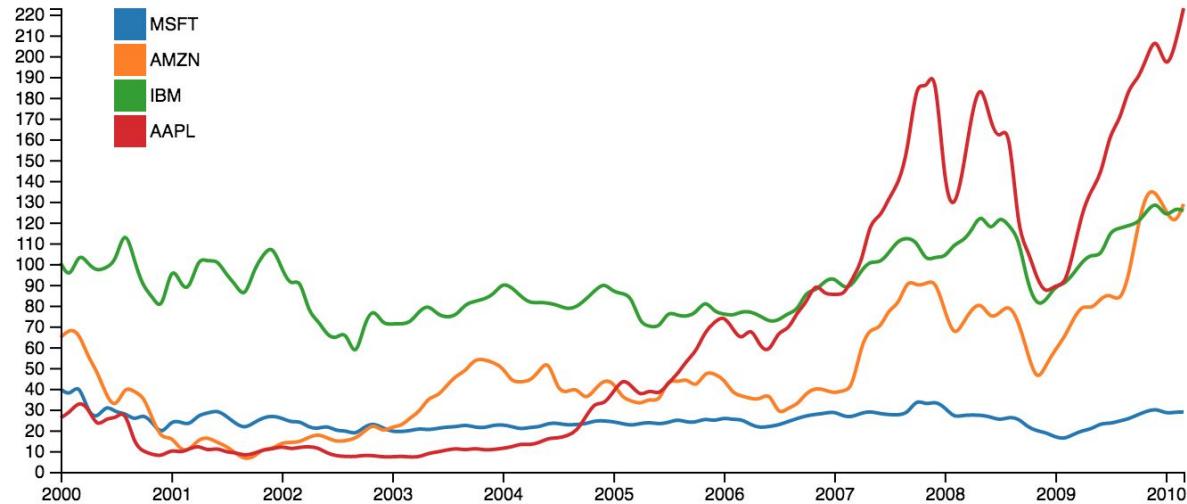
compute domains

d3.keys - compute column names

d3.axis - display axes

d3.line - display line shape

+ legend!



Stock market data

symbol,date,price

MSFT,Jan 2000,39.81

MSFT,Feb 2000,36.35

MSFT,Mar 2000,43.22

MSFT,Apr 2000,28.37

IBM,Jan 2010,121.85

IBM,Feb 2010,127.16

IBM,Mar 2010,125.55

AAPL,Jan 2000,25.94

AAPL,Feb 2000,28.66

AAPL,Mar 2000,33.95

