D3.js Introduction

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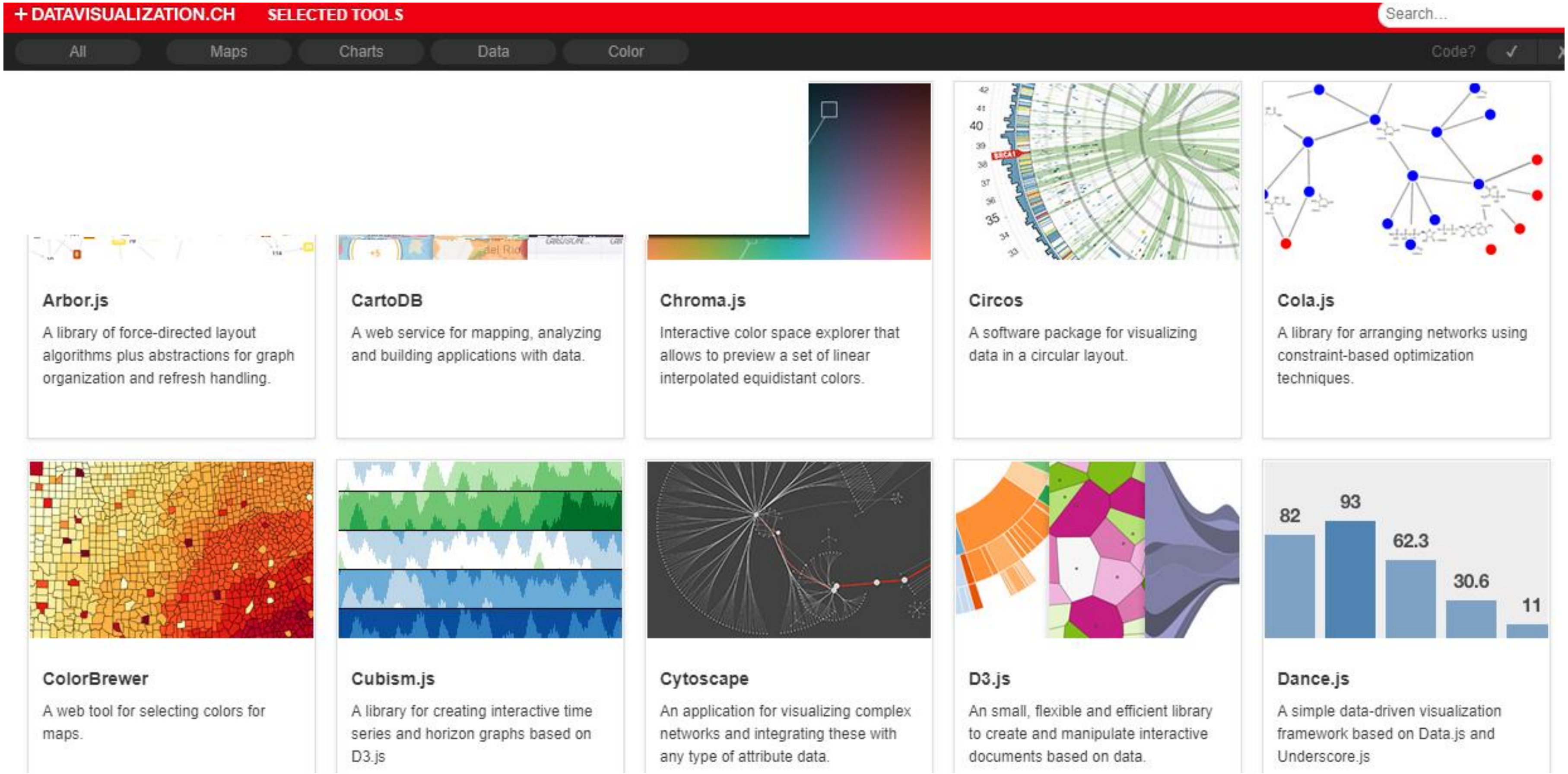
Visualization – Depends in application

- Exploratory (discover pattern, multiple views) or Explanatory (View of the data presenting discovered highlights)
- Type of data (Maps, Charts, Data,…)
- Developer or non-developer?
- Scientific or information Visualization (2D,3D, structure or not?)
- Interactive or Static?
- Web or local?
- Easy to use or Flexible?
- Protection of data?
- …

Visualization Tools

- There are a lot, of different types and with different purposes

(see e.g. http://selection.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

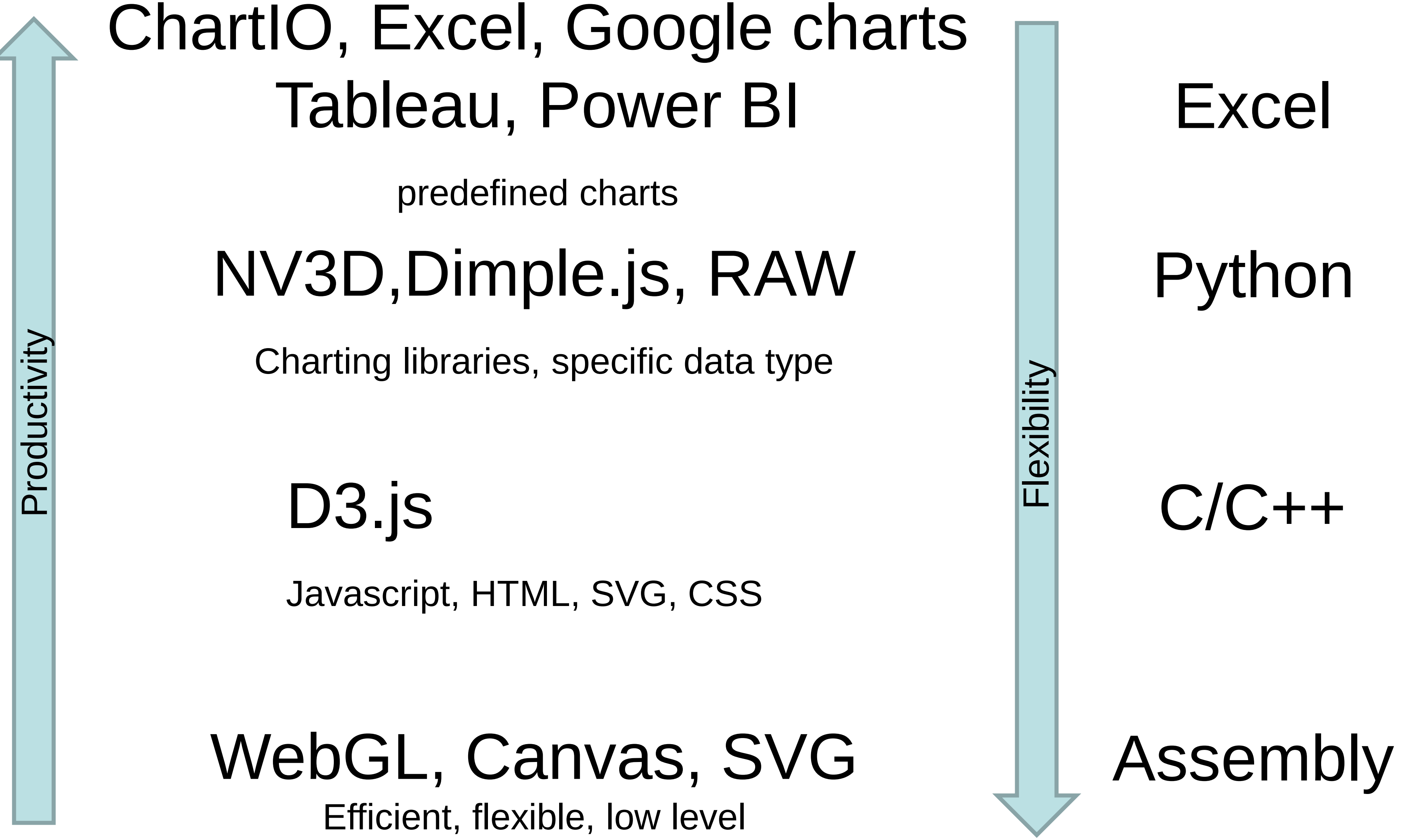
A simple data-driven visualization framework based on Data.js and Underscore.js

Visualization – what to choose

- http://selection.datavisualization.ch
- Filters available
    - Maps
    - Charts
    - Data
    - Color

    - Developer
    - Non-developer

Visualization tools



Productivity

ChartIO, Excel, Google charts

Tableau, Power BI

predefined charts

NV3D,Dimple.js, RAW

Charting libraries, specific data type

D3.js

Javascript, HTML, SVG, CSS

WebGL, Canvas, SVG

Efficient, flexible, low level

Flexibility

Excel

Python

C/C++

Assembly

Visualization – what to choose

- If you are in a large company: Tableau or Spotfire may be adequate (very powerful and expensive business intelligence S/W)
- If you want to produce an interactive visualization Web application to visual explore data: D3.js
- If you just want to make a few simple charts for your web page: google charts, excel

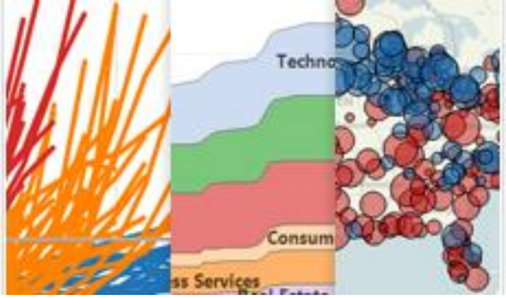
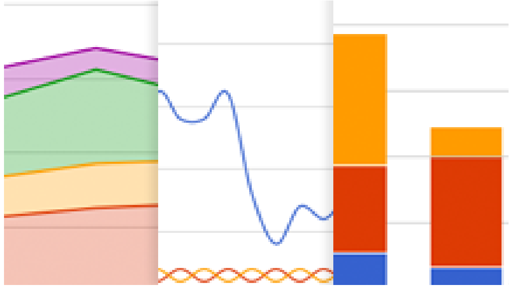


Tableau Public

A desktop application to build and post interactive graphs, dashboards, maps and tables to the web.

D3.js

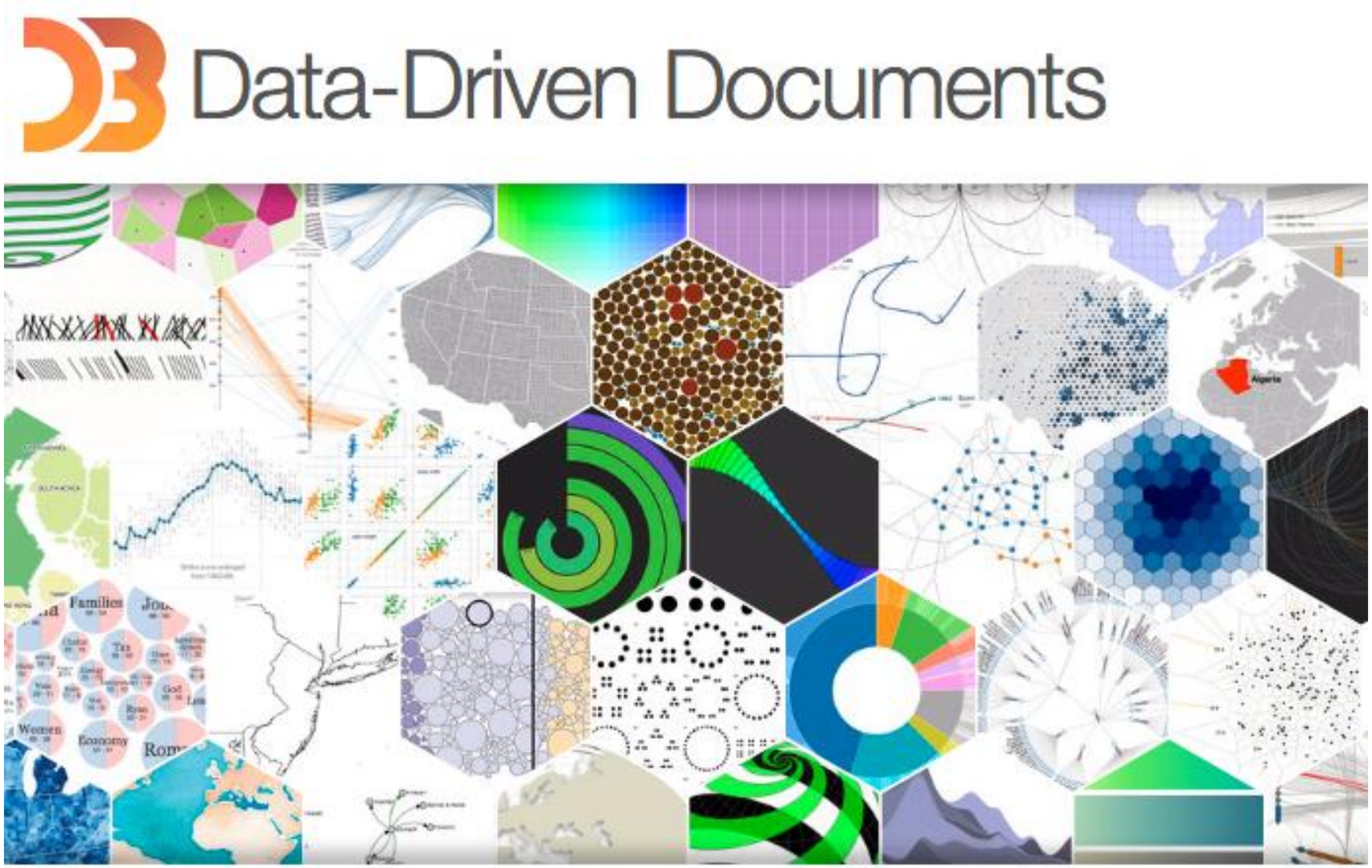
An small, flexible and efficient library to create and manipulate interactive documents based on data.



Google Chart Tools

A collection of simple to use, customizable and free to use interactive charts and data tools.

d3 – Data Driven Documents



D3: Data Driven Documents

d3 - Introduction

- 1996: first browser with JavaScript
- 2005: J. Heer et al.’s prefuse toolkit
- 2007: J. Heer’s Flare toolkit
- 2009: J. Heer + M. Bostock – Protovis
- 2011: D3

D3 – Data Driven Documents

- Visualization requires visual encoding: mapping data to visual elements.
- The HTML Document Object Model has a rich set of features and standards for visual display
- A tool not to replace the web and modern browser’s toolbox, but exposes it an easy way to use.
- d3 allows transformation of the HTML DOM from text document to Visualization

D3 – Web Standards

- “Learning D3” is largely learning web standards.

- The **Document** refers to the *W3C Document Object Model*

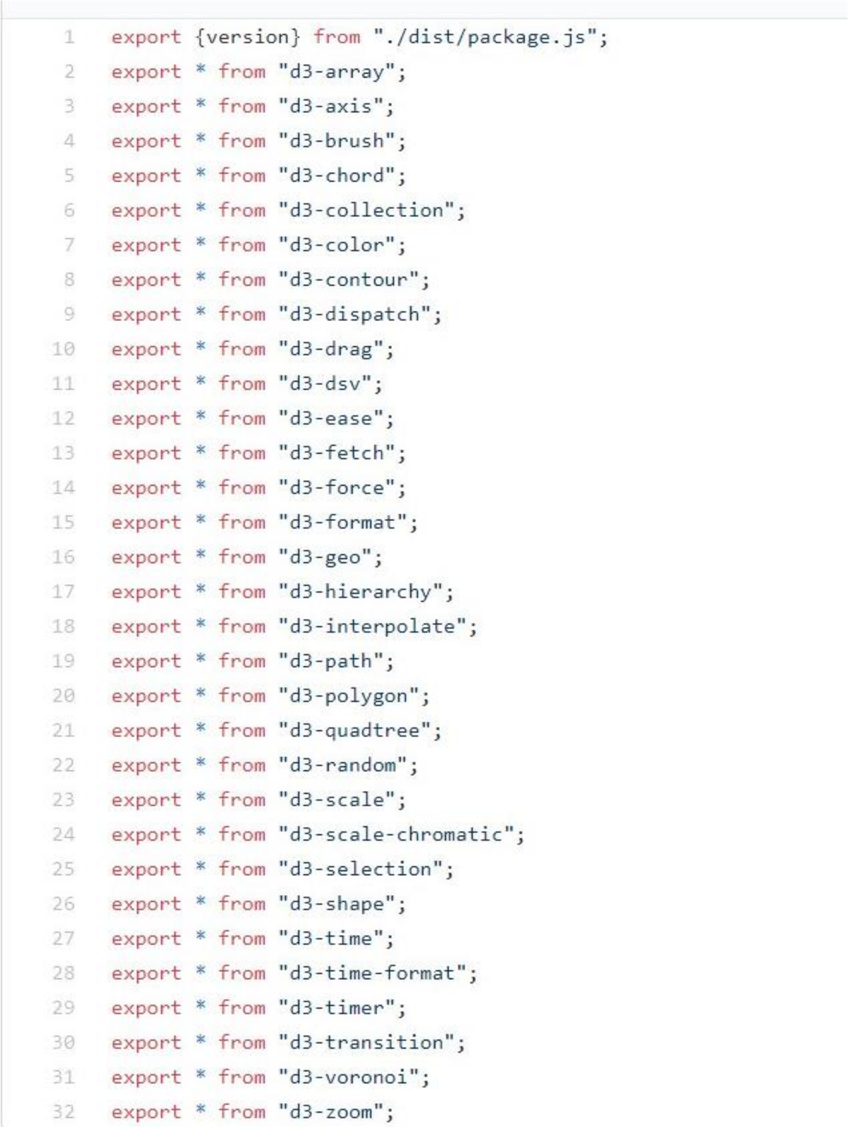
- Unlike Processing or Protovis, D3’s vocabulary of graphical marks comes directly from web standards: HTML, SVG, and CSS.

D3 - Library

- D3 allows you to bind arbitrary data to a Document Object Model (DOM), and then apply data-driven transformations to the document.

- D3 isn’t a monolithic framework; it’s a suite of small modules (31) for data analysis and visualization.

D3 - Library



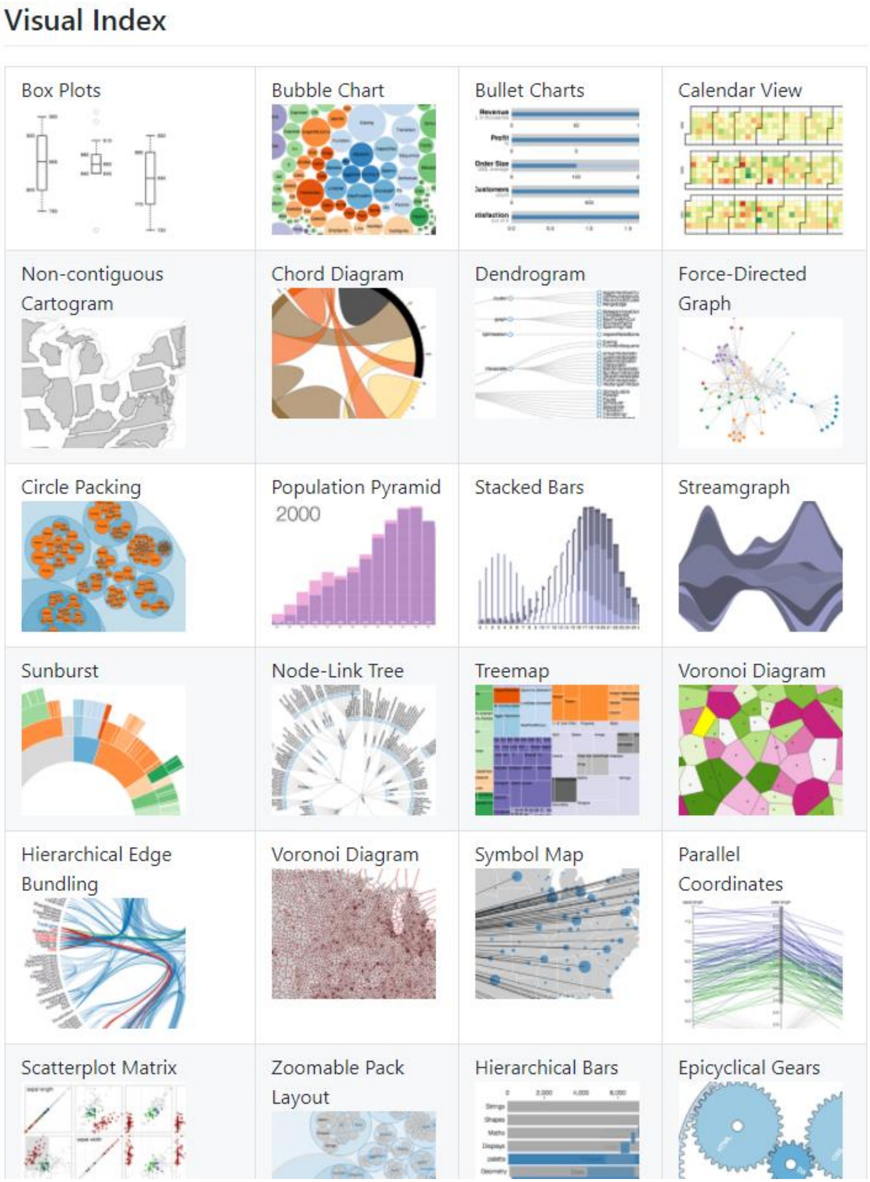
```
export {version} from "./dist/package.js";
export * from "d3-array";
export * from "d3-axis";
export * from "d3-brush";
export * from "d3-chord";
export * from "d3-collection";
export * from "d3-color";
export * from "d3-contour";
export * from "d3-dispatch";
export * from "d3-drag";
export * from "d3-dsv";
export * from "d3-ease";
export * from "d3-fetch";
export * from "d3-force";
export * from "d3-format";
export * from "d3-geo";
export * from "d3-hierarchy";
export * from "d3-interpolate";
export * from "d3-path";
export * from "d3-polygon";
export * from "d3-quadtree";
export * from "d3-random";
export * from "d3-scale";
export * from "d3-scale-chromatic";
export * from "d3-selection";
export * from "d3-shape";
export * from "d3-time";
export * from "d3-time-format";
export * from "d3-timer";
export * from "d3-transition";
export * from "d3-voronoi";
export * from "d3-zoom";
```

SVG
HTML
5
CSS
3
JavaScript
JS

D3.JS - Data Driven Documents

d3 – templates and gallery

https://github.com/d3/d3/wiki/Gallery



Visual Index

Box Plots	Bubble Chart	Bullet Charts	Calendar View
Non-contiguous Cartogram	Chord Diagram	Dendrogram	Force-Directed Graph
Circle Packing	Population Pyramid	Stacked Bars	Streamgraph
Sunburst	Node-Link Tree	Treemap	Voronoi Diagram
Hierarchical Edge Bundling	Voronoi Diagram	Symbol Map	Parallel Coordinates
Scatterplot Matrix	Zoomable Pack Layout	Hierarchical Bars	Epicyclical Gears

D3 - Introduction

- JavaScript library for creating data visualizations

- Data-Driven Documents
  - User provides the data
  - D3 does the driving
  - I.e., it connects the data to web-based documents

- Mike Bostock

- d3js.org

d3 - Introduction

- No support for older browsers

- No handling of bitmap map tiles
  - Vector graphics instead

- No hiding of original data
  - Client-side execution
  - Data must be sent to the client
  - Do not use D3 if your data cannot be shared !

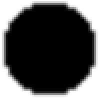
d3 – Generating page elements

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <title>D3 Page Template</title>
    <script type="text/javascript“ src=“http://d3js.org/d3.v7.min.js"></script>
  </head>
  <body>
    <script type="text/javascript">
      <! D3 Code here >
    </script>
  </body>
</html>
```

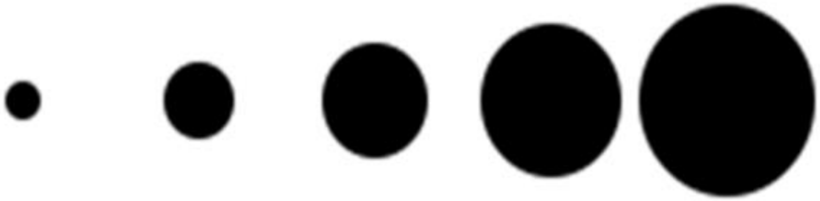
Content Delivery Network (CDN)
src=“http://d3js.org/d3.v7.min.js”
Locally:
src=“../d3.min.js”

d3- Circle drawing

```
var dataset = [5, 10, 15, 20, 25];

var w = 500;
var h = 50;
var svg = d3.select("body")
                    .append("svg")
                    .attr("width", w)
                    .attr("height", h);

var circles = svg.selectAll("circle")
                    .data(dataset)
                    .enter()
                    .append("circle");

circles.attr("cx", "10")
                    .attr("cy", "10")
                    .attr("r", "10");
```



d3- Circle drawing



```
…
        var circles = svg.selectAll("circle")
                        .data(dataset)
                        .enter()
                       .append("circle");

        circles.attr("cx", function(d, i) {
                        return (i * 50) + 25;
                        })
                        .attr("cy", h/2)
                        .attr("r", function(d) {
                                return d;
                         });
```

d3 - Resources

- https://bost.ocks.org/mike/d3/workshop/#0
- https://blockbuilder.org/
- https://observablehq.com/
- https://github.com/wbkd/awesome-d3
- https://github.com/d3/d3/wiki/Gallery
- https://d3-discovery.net/
- https://observablehq.com/@d3/