Making data visualisations like a pro: D3.js

Direction Access to and Reuse of Public Information

Unit EU Open Data and CORDIS

Sector EU Open Data
ISA2 programme

What’s ISA2?

ISA2 supports the development of digital solutions enabling public administrations, businesses and citizens in Europe to benefit from interoperable cross-border and cross-sector public services.

How OP is involved in ISA2?

OP is aiming at improving open services in the areas of:

- Data visualisation
- Linked open data
- Persistent identification
# Upcoming training & workshop sessions

<table>
<thead>
<tr>
<th>Topic</th>
<th>Type of session</th>
<th>Lux.</th>
<th>Bxl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Going beyond bars and lines</td>
<td>Training</td>
<td>-</td>
<td>30/09</td>
</tr>
<tr>
<td>Telling your story through data visualisation</td>
<td>Training</td>
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<tr>
<td>Making great online visualisations without coding</td>
<td>Training</td>
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<td>4/10</td>
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<tr>
<td>Applying data visualisation in use cases</td>
<td>Workshop</td>
<td>24/10</td>
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</table>
Upcoming webinars

Learn more details on webinar and registration on Joinup:

Learn more details on webinar and registration on Joinup:

e-mail: op-odp-contact@publications.europa.eu
Conference EU DataViz, 12 November 2019

e-mail: op-eu-dataviz@publications.europa.eu
Agenda

09:00  Introduction
       Web development 101
10:30  Coffee break
       D3.js
       Exercise: drawing with D3.js
12:00 - 13:00  Lunch
       Exercise: An animated bubble chart with D3.js
14:30  Coffee break
       Exercise: An animated bubble chart with D3.js
16:30  Q&A
1. INTRODUCTION
Participants

Institution/DG and role?
What data and tools do you work with?
Experience in data visualisation?
Coding skills?
WEB DEVELOPMENT 101
Webdev 101
html

HyperText Markup Language

Structure of a webpage, rendered by browsers

Consists of elements/tags, in a hierarchical way

<html>
  <h1>Hello class!</h1>
  <p>Today we are going to make awesome graphics <span>with D3!</span></p>
  <img src="https://media.giphy.com/media/QHE5gWI0QjqF2/giphy.gif"/>
</html>
Webdev 101

**svg**

Scalable Vector Graphics

Scalable images for the web

Part of html

Text based

Animatable

```
<svg width="100" height="100">
  <circle cx="50" cy="50" r="40"
    stroke="green"
    stroke-width="4"
    fill="yellow"/>
</svg>
```
Webdev 101

CSS

Cascading Style Sheets

How html elements should be displayed

In separate .css file, or inline in html

body {
    font-family: Arial
}

h1 {
    font-size: 52px
}

p {
    font-size: 24px
}

span {
    background-color: #910000;
    padding-left: 4px;
    padding-right: 4px;
    color: white;
}
Webdev 101

javascript

Language to make webpages dynamic
Update content
Animations
Control multimedia

...
Webdev 101
Servers & clients

Files (.html, .css, .js) are served to the client by a server

To develop a web visualisation, you need a server

But we will use jsbin instead
Webdev 101
Exercise
Open webpage
View source: click-right => View page source
Inspect element: click-right => Inspect element

In Developer Tools:
  Inspector
  Styles
  Console
Webdev 101
Exercise: JSBin

Open [jsbin.com/zukasex/2/edit](jsbin.com/zukasex/2/edit) and play around a little bit

Add

```javascript
console.log("Logging to the console");
```

to the javascript, and open the console tab

Add

```javascript
var sum = 4 + 12;
console.log(sum);
```

to the javascript
2. D3.JS
D3.js
Bind data to html-elements

D3js.org

Data Driven Documents

"A JavaScript library for manipulating documents based on data. D3 helps you bring data to life using HTML, SVG, and CSS"
D3.js Functions
Selecting elements
Creating elements
Data loading
Data transformations
Scales
Colors
Chart layouts
Maps
Number and date/time formatting

The D3 API
D3.js is not...  
... a charting library, it has no ready made charts
... very easy to learn
... a data analytics tool
D3.js
Examples

Basic example: Basic pie

More examples:
Gallery
Blockbuilder (search)

Advanced:
Nadieh Bremer
visualcinnamon.com
D3.js
When to use

- Animated charts
- Dynamic charts
- Custom chart types
- Visualising data on the web
3.

A BUBBLE CHART WITH D3.JS
D3.js
What we are going to make

Gapminder bubble chart
D3.js
Exercise: setup
Go to jsbin.com

Keep 1 jsbin open and try to follow me. Open the solutions if you get stuck

Load version 5 of D3 (see d3js.org homepage)
Set up svg, 800 pixels wide and 600 pixels high
Solution: jsbin.com/nipefeb/1/edit

Append a circle to the svg with d3
jsbin.com/nipefeb/2/edit
A bubble chart

Data

Inline data

```
var data = [
    {"name": "datapoint1", "value": 20},,
    {"name": "datapoint2", "value": 33}
]
```

Load csv

```
d3.csv()
```

Log data

```
console.log(data)
```
A bubble chart
Draw elements with data

Select elements

Bind data with .data()

svg.selectAll("circle")
.data(circledata)
.enter()
.append("circle")
.attr("cx", (d) => d.x)
.attr("cy", (d) => d.y)
.attr("r", (d) => d.radius)
D3.js
Draw circles

Draw 2 (or more circles) from data with D3
jsbin.com/nipefeb/4/edit
A bubble chart

Scales

Map data to visual properties of elements

From input domain to output range

d3.scaleLinear()
A bubble chart
Load data, set up scales

Load data with d3.csv and convert to numbers

Define linear X scale
Define linear Y scale (from bottom to top)

jsbin.com/nipefeb/7/edit
A bubble chart

**Scales**

- `d3.scaleSqrt()` for radius
- `d3.scaleOrdinal()` for colors

**Stroke & Fill Properties**

- 2 ways of adding color: as a style attribute, or through classes and css

- `d3.scaleLog()`
A bubble chart
Scale and fill circles, logarithmic scale

Scale circles with d3.scaleSqrt()
jsbin.com/nipefeb/8/edit

Convert X scale to logarithmic scale with d3.scaleLog()
jsbin.com/nipefeb/10/edit

Add scale to fill circles by continent
jsbin.com/nipefeb/11/edit
A bubble chart

Sort data

Sort data to show small bubbles on top

data.sort(function(a,b){
  return b.population - a.population;
})

Not D3, but "vanilla" javascript
A bubble chart
Sort data

Sort the data (also try to revert the sorting)
jsbin.com/nipefeb/12/edit
A bubble chart
Plot margins

D3 margin convention

Add a `<g>` element

Transform

Adjust scales

d3.axisBottom()
d3.axisLeft()
A bubble chart
Margins convention, x and y axes

jsbin.com/nipefeb/14/edit
A bubble chart

Number formats

axis.tickFormat()

axis.tickSizeInner()

.append("text")

Style text with css
A bubble chart
Tick format and tick size

Format numbers
jsbin.com/nipefeb/15/edit

Add grid with negative inner tick size
jsbin.com/nipefeb/16/edit

Text for the year
jsbin.com/nipefeb/18/edit
A bubble chart

**Interactivity: tooltips**

Tooltip

Adding a div element

tooltip.on("mouseover", ...)

tooltip.on("mouseout", ...)

A bubble chart
Tooltips

Add a tooltip

jsbin.com/nipefeb/19/edit
A bubble chart

**Interactivity:** animation

New data

Convert new data to numbers

<input type="radio">

.on("change", ...)

A bubble chart
Animation

Load and convert new csv file
jsbin.com/nipefeb/21/edit

Add radio buttons and add event listener
jsbin.com/nipefeb/23/edit
A bubble chart

Interactivity: animation

.transition().duration()
A bubble chart
Animation

Add animation with .transition()

jsbin.com/nipefeb/24/edit
A bubble chart

**Interactivity:**

- animation

`.easing()`

Update text
A bubble chart
Animation

Change the easing for 1 of the animations
jsbin.com/nipefeb/26/edit

Update the text to the selected year
4.

OTHER CHARTS
Other charts

Bar chart

Basic Bar Chart

d3.scaleBand()

rect elements, with width and height (reversed y scale)
Other charts
Stacked bar chart

d3.stack()
Other charts
Line and area charts

d3.line()

D3 v5 line chart
d3.scaleTime()
Other charts

Layouts

d3.treemap()

d3.chord()

d3.forceSimulation()

D3 showreel
Q&A
Resources

Sites
D3.js
Blocks
Blockbuilder
Stack Overflow

Books
D3.js by Example
How to learn D3.js
Fullstack D3 and Data Visualization
Interactive Dataviz for the Web
D3.js in action
Best D3.js books for teaching yourself data visualisation with javascript

Courses
DashingD3js
Coursera
Udacity
Udemy
Pluralsight