Introduction to the D3 library

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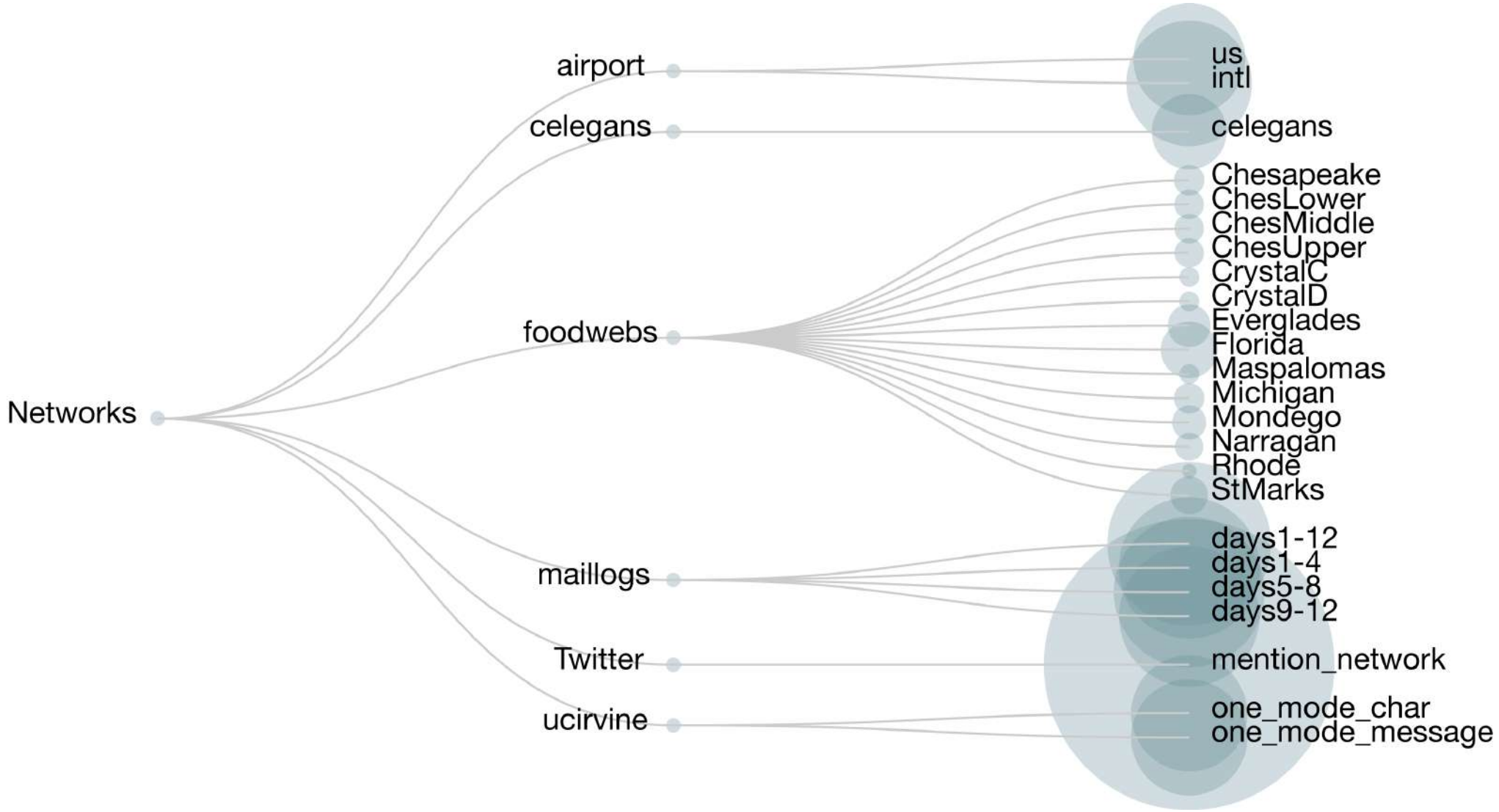
Contents

- The anatomy of a webpage
- First D3.js script for SVG manipulation
- Some cool layouts

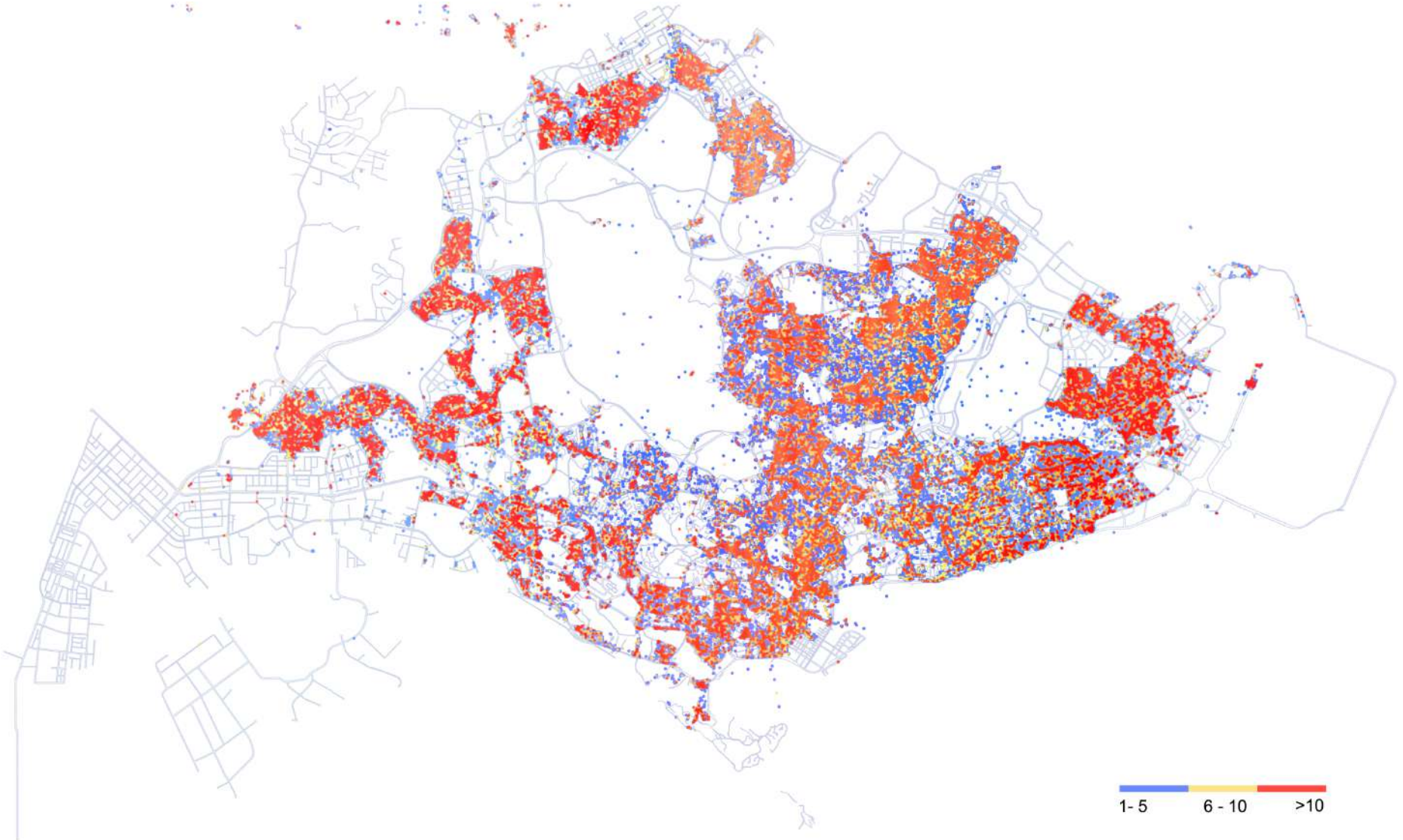
D3 is awesome for...

- Creating interactive data visualization
- Tying the visualizations with maps, geographical data
- Manipulating webpages *à la* jQuery
- With D3 available on Node.js, access to cool data manipulation procedures

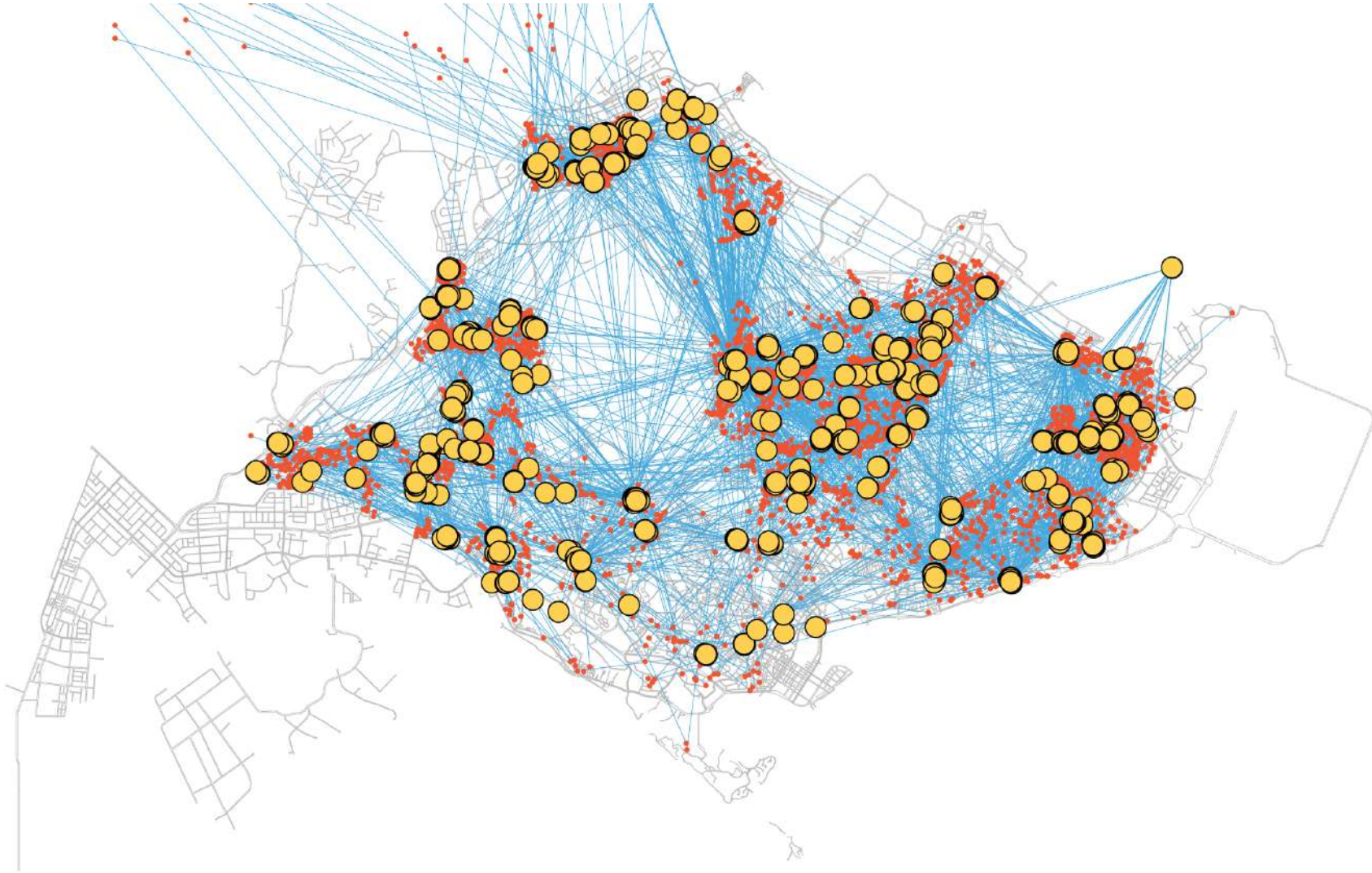
Some examples



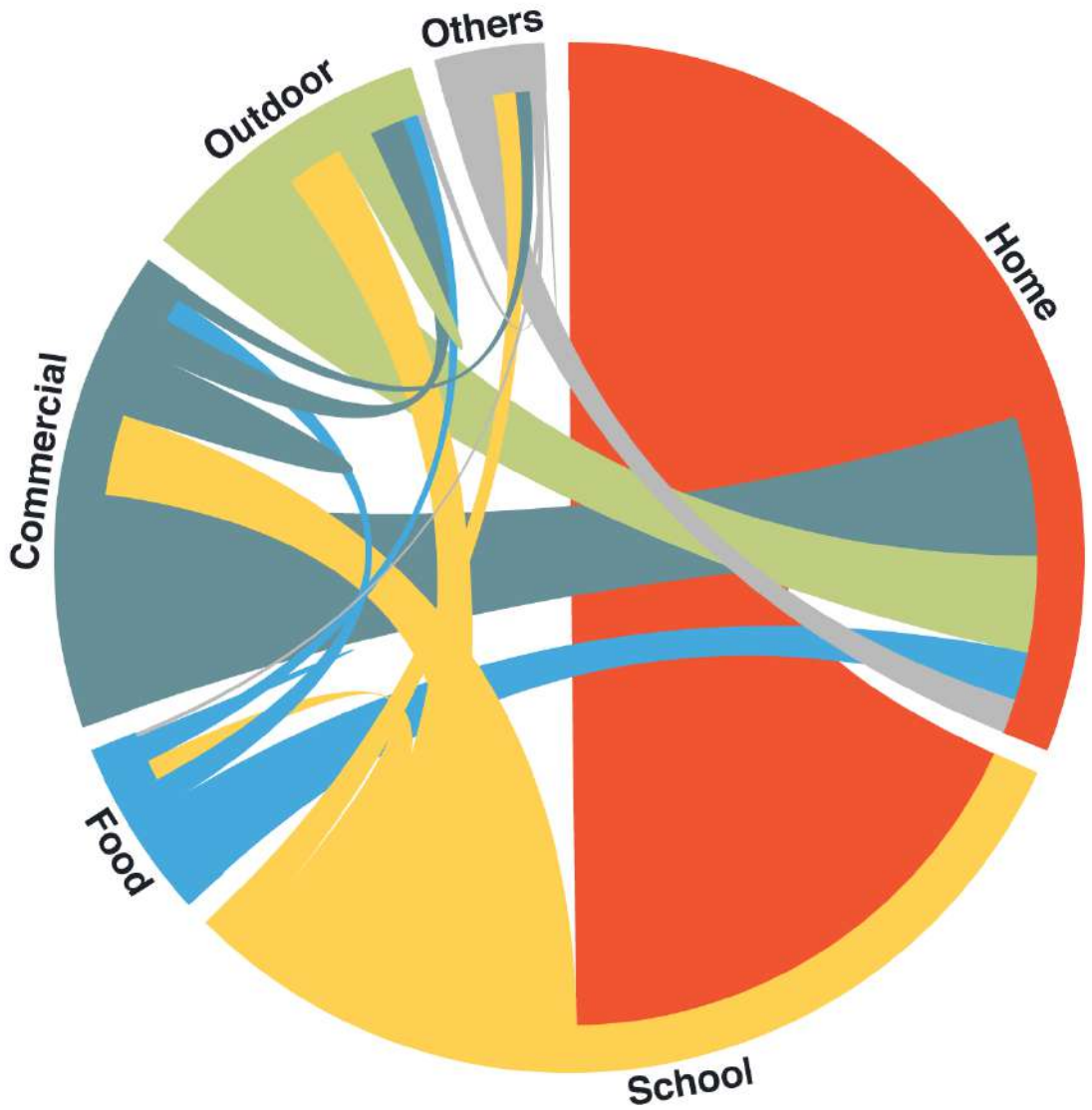
Some examples



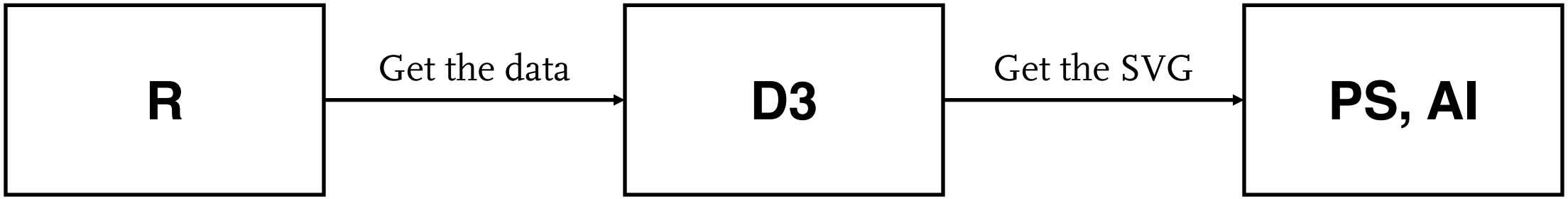
Some examples



Some examples



Typical workflow



Mike Bostock

- D3 was created by Mike Bostock
- Evolved from the subject of his PhD thesis, working on a language, *Protovis*, to visualize data
- He is now in charge of making great interactive data visualizations for the New York Times (example, example)

First example: Bar chart

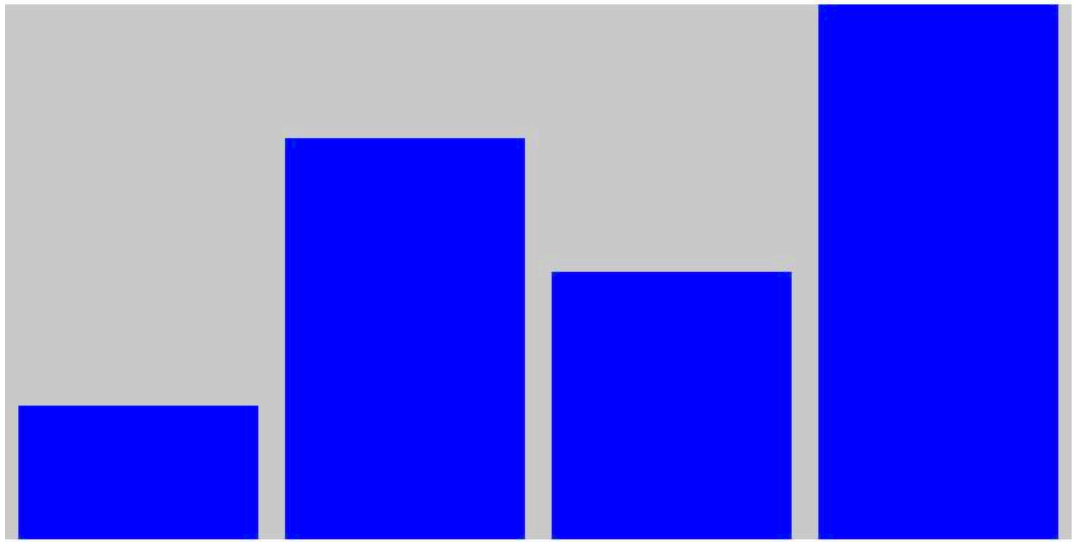
- Nothing fancy, but introduces key concepts such as:
  - Drawing in a webpage
  - Selections
  - Data-binding
  - Enter/Update/Exit pattern
  - Scales

First example: Bar chart

- Let's create a JSFiddle, go to jsfiddle.net

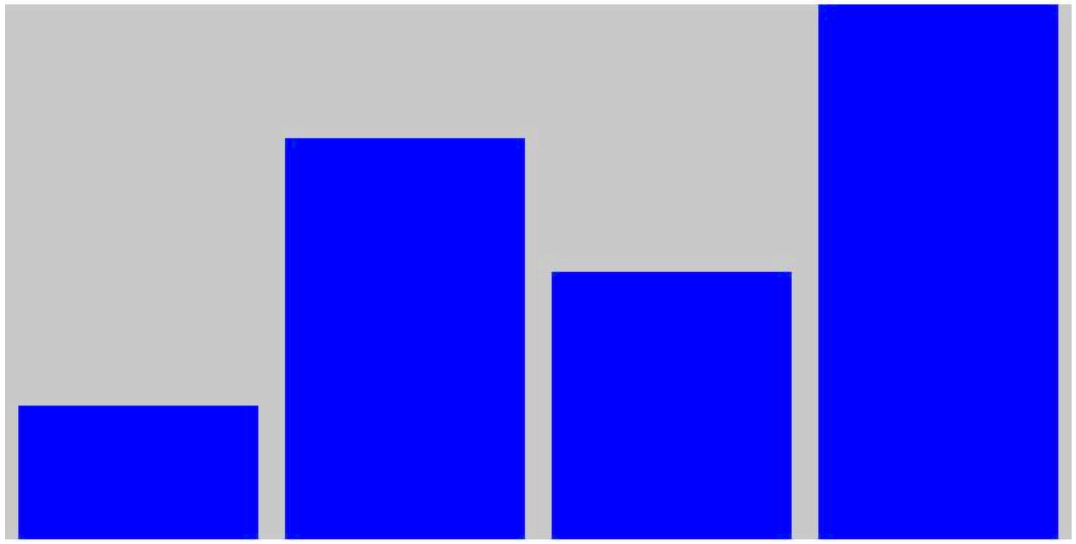
First example: Bar chart

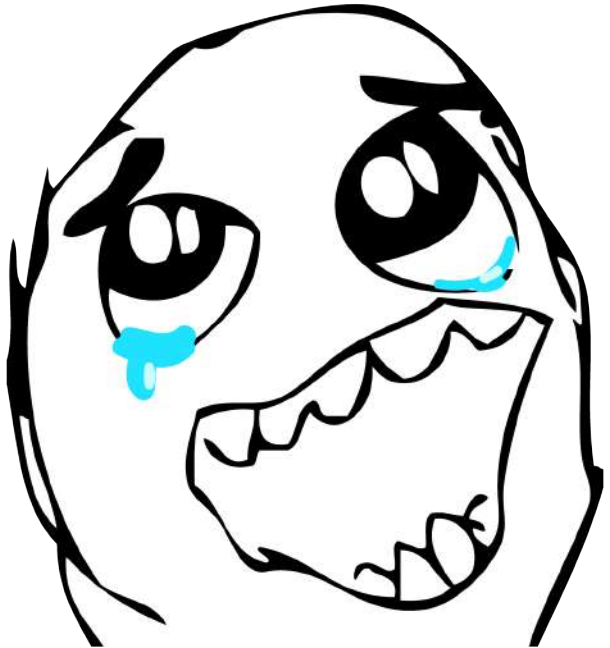
- What we want



First example: Bar chart

- What we want

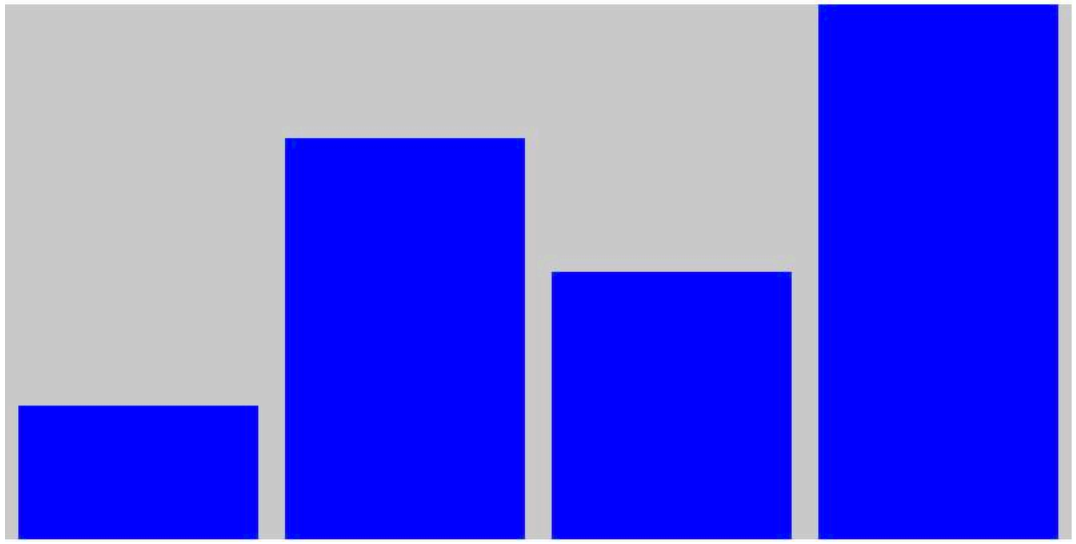




My eyes are burning!

First example: Bar chart

- What we want



Top bar takes all the height

Notice *10* px margin here

HTML first

- HTML is made up of tags, such as `h1` or `div`
- `div` is a particular one: defines a box in which to draw (text, image…)
- Tags can be given id's (unique) and classes (reusable)

```
<h1 id='title'></h1>
<p class='myp'></p>
```

- When we refer to them (in CSS or with D3), use `#` for titles and `.` for classes

```
#title // refers to the h1 title tagged #title
.myp // refers to all elements classed .myp
```

Selections

- D3 acts on selections of objects

```
d3.select("#title")
```

  selects the DOM element named `#title`

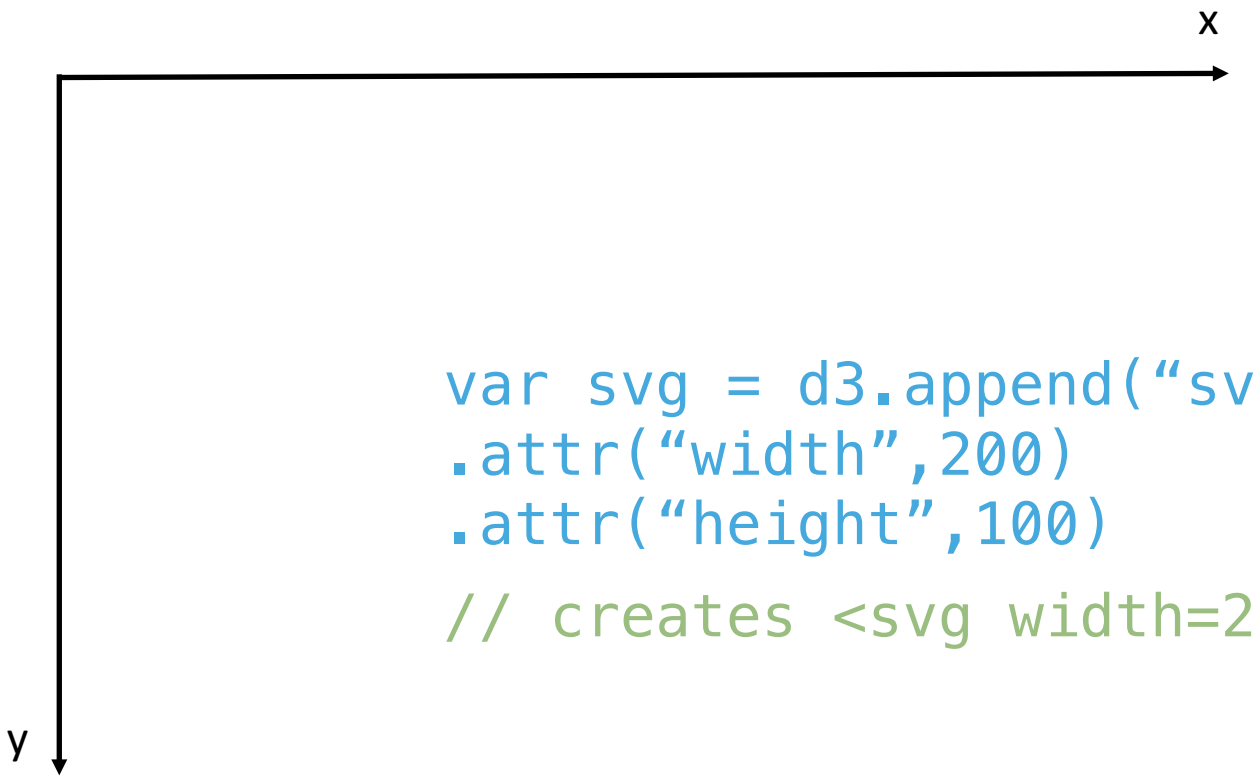
- Once we have selected an object, we can change its attributes

```
// Set content of h1 tag
d3.select("#title").text("Introduction")
```

- We can also select *all* objects that have a certain property

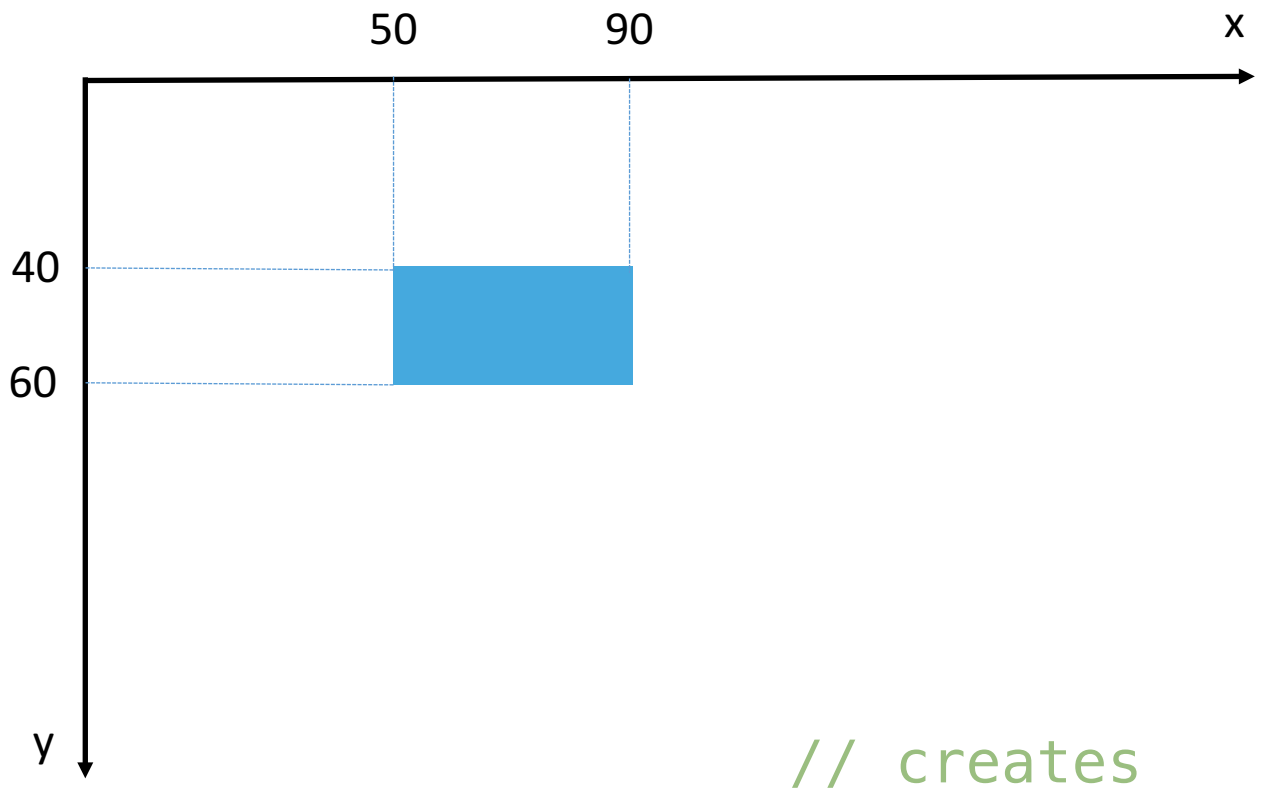
```
// Select all elements classed bar
d3.selectAll(".bar")
```

SVG




```
var svg = d3.append(“svg”)
.attr(“width”,200)
.attr(“height”,100)
// creates <svg width=200 height=100>
```

SVG



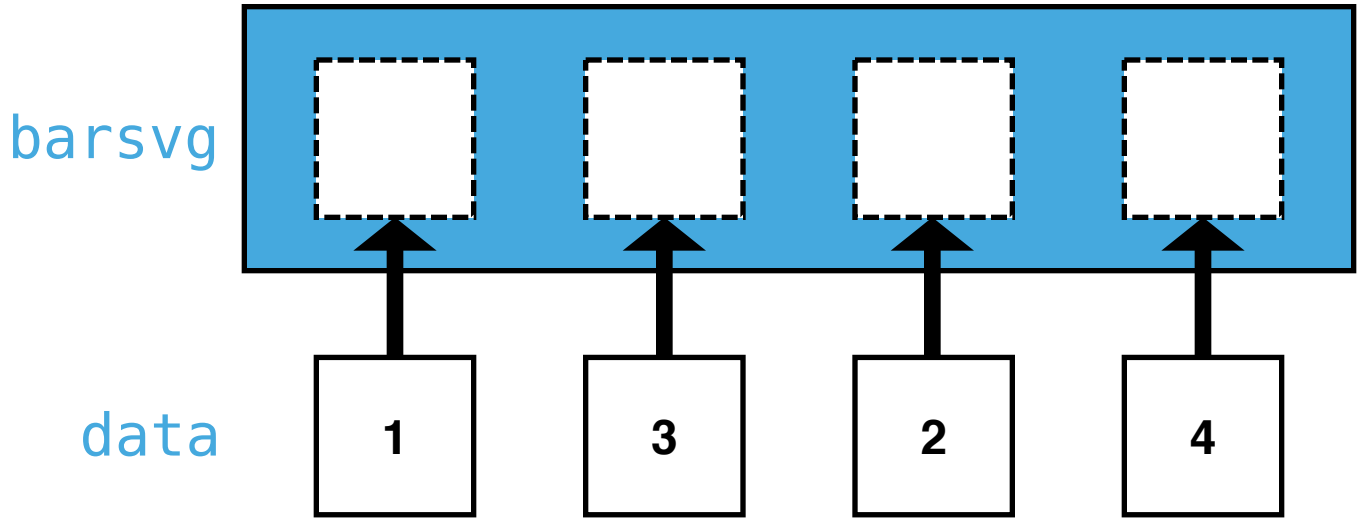

```
svg.append(“rect”)
.attr(“height”, 20)
.attr(“width”, 40)
.attr(“x”, 50)
.attr(“y”, 40)
.attr(“fill”, “blue”)
```

```
// creates
<svg width=200 height=100>
      <rect x=50 y=40 height=20 width=40>
</svg>
```

Data-binding

- We want to *draw* the data `var data = [1, 3, 2, 4];`
- Each piece of data will be represented by a rectangle classed `.bar`
- We select all `.bar` elements and attach the data to it

```
var barsvg = d3.selectAll(".bar").data(data);
```

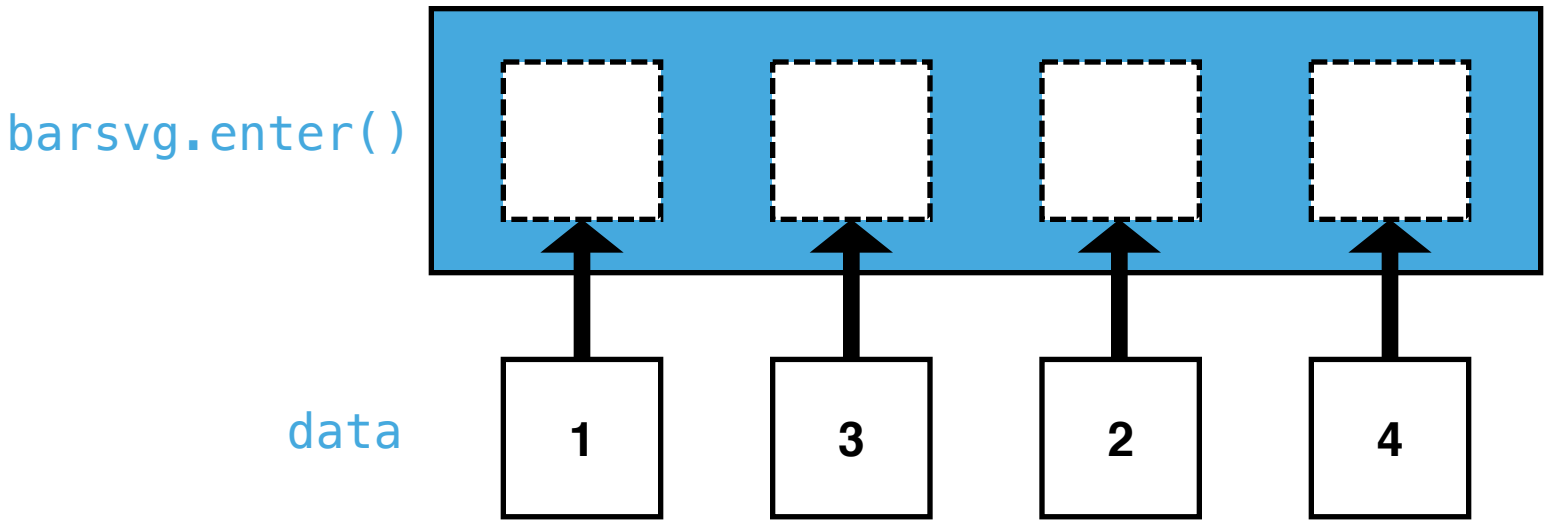


Enter selection

- We can get the enter selection via the `enter()` function applied to our selection `barsvg`

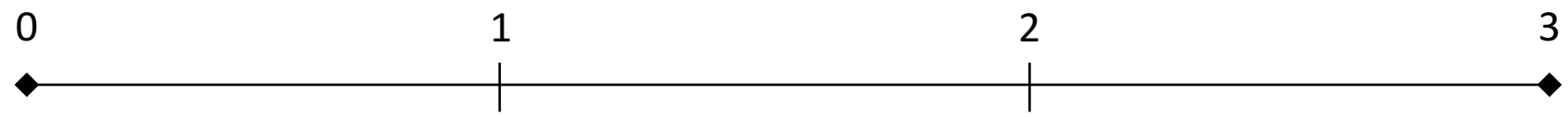
```
barsvg.enter()
```

- The enter selection corresponds to the dashed boxes below: data that is yet to be drawn

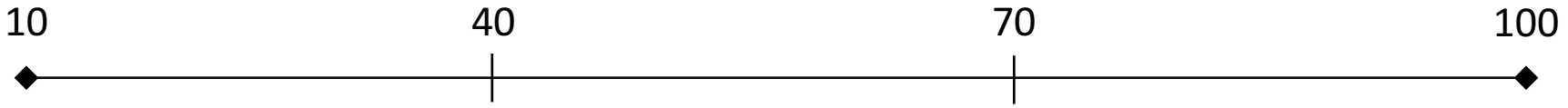


Scales

- Scales are an easy way to map inputs from a domain to outputs in a range
- There are a couple of cool options to work with: linear scales, logarithmic, qualitative…




```
var scale = d3.scale.linear().domain([0,3]).range([10,100])
```



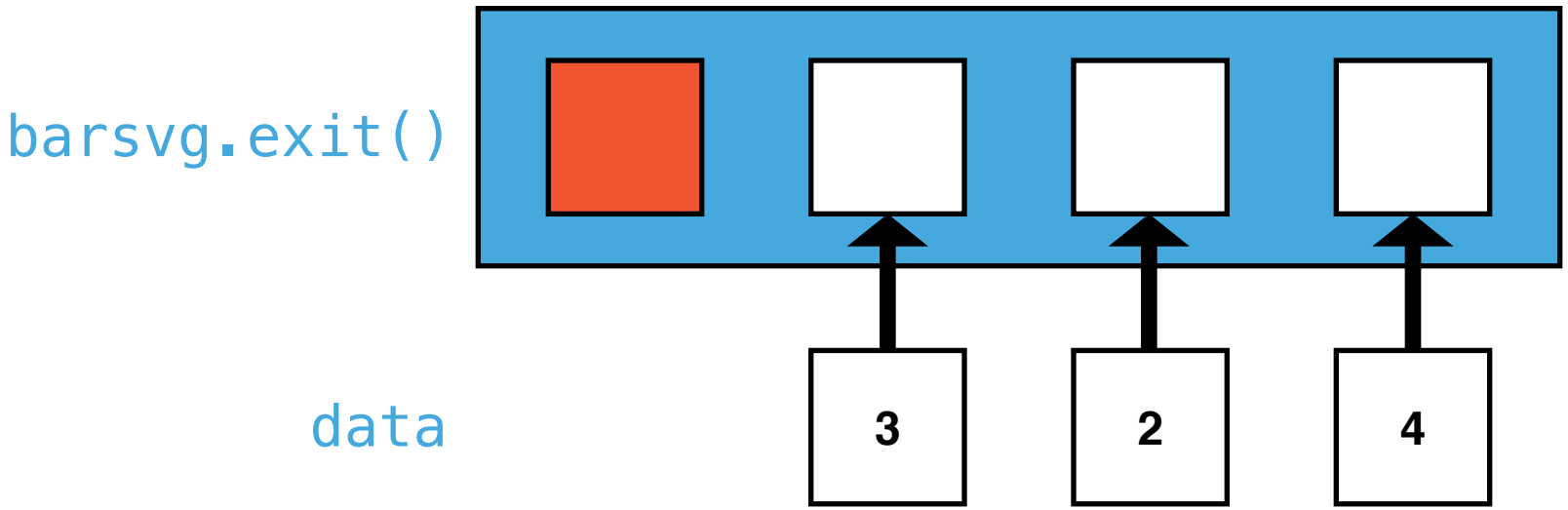

```
scale(1) = 40        scale(2) = 70
```

Exit selection

- We can get the exit selection via the `exit()` function applied to our selection `barsvg`

```
barsvg.exit()
```

- The exit selection corresponds to the dashed boxes below: data that is yet to be removed from the drawing



Example: drawing a treemap

- D3 comes packaged with lots of nice layouts: force (network), dendogram (shown in the first slides) …
- What this means is it computes boundaries for you, and your job is simply to draw them! => can then animate, make interactive …
- Here we learn:
  - Using a layout
  - Color scales
  - Not drawing SVG (using standard HTML elements)

No more Fiddle

- We can't use JSFiddle anymore: can't load external resources in there...
- Fire up your favorite code editor (Notepad++, Sublime, Atom, TextMate, ...)
- Create a *d3* folder somewhere (e.g, on your Desktop)
- Create a new file treemap.html

The HTML boilerplate

- We can't use JSFiddle anymore, so we write a bit more HTML!

```
<!DOCTYPE html>
<html>
    <meta>
        <title>D3 is awesome!</title>
        <script src="https://d3js.org/d3.v3.min.js" charset="utf-8"></script>
    </meta>
    <body>
         // Where JSFiddle HTML was
    </body>
</html>
```

The HTML boilerplate

- We add a `script` tag under the `body` one

```
<!DOCTYPE html>
<html>
    <meta>
        <title>Malta</title>
        <script src="https://d3js.org/d3.v3.min.js" charset="utf-8"></script>
    </meta>
    <body>
         // Where JSFiddle HTML was
    </body>
    <script>
         // Your code goes here
    </script>
</html>
```

Getting the data

- Go to barnabemonnot.com/d3/data
- Decompress the zip in your D3 folder
- Open RStudio (yes! yes!)
- Use setwd() to set the directory to your D3 folder
- Remember last week? Use dplyr
- If you don't have R, or I don't have enough time, skip this part ☺

R code

```
install.packages("dplyr")
library("dplyr")

dat <- read.csv("imports_manufactures.csv")
names <- read.csv("importkey.csv")
total <- dat %>%
  group_by(from) %>%
  summarise(sum(size)) %>%
  left_join(names, by=c("from"="id")) %>%
  select(name,2)

write.table(total, file="imports.csv", row.names=FALSE, col.names=FALSE, sep=",")
```

Example: drawing a map

- D3 is also a breeze to work with maps.
- Here we learn:
  - Loading external resources
  - Create groups in our SVG
  - Work with map data
  - Where Malta is
  - Respond to events and transitions

Example: drawing a map

- Go to barnabemonnot.com/d3/malta
- Get the code and paste it in a new file, *malta.html*, inside your D3 folder
- We are going to complete parts of it

SVG groups

- Groups are nice to create layers to your drawing, easier then to reorder them if necessary

```
<svg width=200 height=100>
    <g class=“borders”></g> // Borders are drawn first
    <g class=“pois”></g> // Then the points of interest
    <g class=“names”></g> // Then the names
</svg>
```