D3: Diving into the library

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Callbacks

Callbacks in JavaScript are a pattern which solve the problem of dealing with its asynchronous behavior. Functions in JavaScript are first-class objects, meaning that they can be passed around as arguments to other functions.

```
$("#btn_1").click(function() {
  alert("Btn 1 Clicked");
});
```

Scales

> *'Scales are functions that map from an input domain to an output range'*
>
> - Mike Bostock

Items and Pixels

```
var dataset = [ 100, 200, 300, 400, 500 ];
```

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- If 500 items are sold, corresponding bar would be 500px
- What if this value changed to 600? 800?
- Requires bigger display to view bars
- How do we scale these values?

Linear Scales

Linear scales is nothing more than normalization, in which we map a numeric value to a new value between 0 and 1, based on the possible minimum and maximum values. For example, 365 days in a year, day 310 maps to 0.85.

With linear scales, the input value is normalized according to the domain, and then the normalized value is scaled to the output range.

Constructing a Scale

```
var scale = d3.scale.linear()
              .domain([100, 500])
              .range([10, 350]);

scale(100); // Returns 10
scale(300); // Returns 180
scale(500); // Returns 350
```

Other Scales

Apart from Linear Scales, D3 provides the following scales:

- sqrt

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- pow

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- sqrt
- pow
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- quantize
- ordinal

The SVG Element

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- Can be included directly within any HTML document

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- Can be included directly within any HTML document
- Supported by all web browsers except IE8 or higher

SVG Shapes

- rect

SVG Shapes

- rect
- circle

SVG Shapes

- rect
- circle
- ellipse

SVG Shapes

- rect
- circle
- ellipse
- line

SVG Shapes

- rect
- circle
- ellipse
- line
- text

SVG Shapes

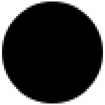
- rect
- circle
- ellipse
- line
- text
- path

rect

```
<rect x="0" y="0" width="500" height="50"/>
```

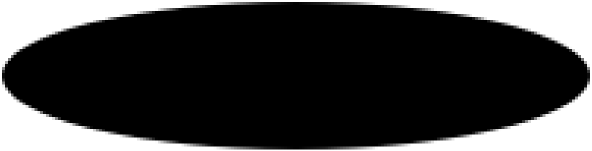
circle

```
<circle cx="250" cy="25" r="25"/>
```



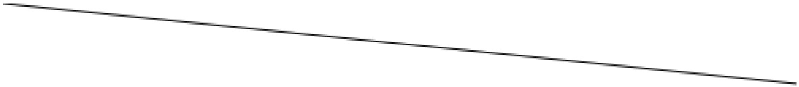
ellipse

```
<ellipse cx="250" cy="25" rx="100" ry="25"/>
```



line

```
<line x1="0" y1="0" x2="500" y2="50" stroke="black"/>
```



Axes

D3 Axes are functions whose parameters we define. When called, it generates the visual elements of the axis, including lines, labels and ticks.

Axes are SVG-specific, as they generate SVG elements. They must be applied to either SVG or SVG **group** elements.

SVG Groups

The **g** element within SVG stands for the *group* element. Group elements are invisible, but they allow us to:

- Contain / **group** elements together

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The **g** element within SVG stands for the *group* element. Group elements are invisible, but they allow us to:

- Contain / **group** elements together
- We can apply transformations to these groups

Constructing an axis function

```
var xAxis = d3.svg.axis()
                .scale(xScale)
                .orient("bottom")
                .ticks(5);

var yAxis = d3.svg.axis()
                .scale(yScale)
                .orient("left")
                .ticks(5);
```

Usage

```
svg.append("g")
    .attr("class", "axis")
    .attr("transform", "translate(0," + (h - padding) +
        ")")
    .call(xAxis);

svg.append("g")
    .attr("class", "axis")
    .attr("transform", "translate(" + padding + ",0)")
    .call(yAxis);
```

An SVG path can draw all sorts of shapes - rectangles, circles, ellipses, straight lines, curves and polygons.

The shape of an SVG Path element is defined by the attribute **d**, which contains the series of commands and parameters from within the SVG Path Mini-Language.

These commands are analogous to a set of instructions for *how to move a pen on paper*.

```
<svg width="100" height="100">
  <path d=" M 10 25
            L 10 75
            L 60 75
            L 10 25"
            stroke="red" stroke-width="2" fill="none" />
</svg>
```

- M 10 25: Put the pen down at (10, 25)

Note that SVG Path commands are case sensitive. **Capitalcase** means we are using *absolute positioning* based on the SVG viewing window, **lowercase** means we are using *relative positioning*.

- M 10 25: Put the pen down at (10, 25)
- L 10 75: Draw a line to the point (10, 75) from (10, 25)

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- M 10 25: Put the pen down at (10, 25)
- L 10 75: Draw a line to the point (10, 75) from (10, 25)
- L 60 75: Draw a line to the point (60, 75) from (10, 75)

Note that SVG Path commands are case sensitive. **Capitalcase** means we are using *absolute positioning* based on the SVG viewing window, **lowercase** means we are using *relative positioning*.

- M 10 25: Put the pen down at (10, 25)
- L 10 75: Draw a line to the point (10, 75) from (10, 25)
- L 60 75: Draw a line to the point (60, 75) from (10, 75)
- L 10 25: Draw a line to the point (10, 25) from (60, 75)

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What are voronoi diagrams?

Voronoi diagrams are a method of dividing space into a set number of regions, based on some input points. For each point, there will be a region containing all points closest to the corresponding input point.

Voronoi diagrams are useful for creating invisible interactive regions, such as: http://www.pointerpointer.com/

Voronoi function

```
// Voronoi generator function
var voronoi = d3.geom.voronoi()
    .x(function(d) { return d.LONGITUDE; })
    .y(function(d) { return d.LATITUDE; })
    .clipExtent([[0, 0], [width, height]]);
```

Update

selection.**data()**: Joins an array of data to the current selection. Results in the *update* selection, which represents the selected DOM elements that were successfully bound to the specified data elements.

The *update* method also contains a reference to the *enter* and *exit* selection, used for adding and removing nodes in correspondence with the data.

Enter

selection.**enter()**: Returns the enter selection - placeholder nodes for each data for which no corresponding existing DOM element was found. Supports the following operators:

- append

Enter

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selection.**enter()**: Returns the enter selection - placeholder nodes for each data for which no corresponding existing DOM element was found. Supports the following operators:

- append
- insert
- select
- call

Exit

selection.**exit()**: Contains existing DOM elements in the current selection for which no data element was found. Exposes the **remove** operator, which allows the removal of these elements.

Example

```
d3.select("body").selectAll("div")
  .data([4, 8, 15, 16, 23, 42])
.enter().append("div")
  .text(function(d) { return d; });
```

Example

```
var div = d3.select("body").selectAll("div")
.data([1, 2, 4, 8, 16, 32], function(d) { return d; });

// Append new data
div.enter().append("div")
  .text(function(d) { return d; });

// Remove existing elements [15, 23, 42]:
div.exit().remove();
```

D3 Resources

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- Stackoverflow