D3: Data Loading, Reference Systems, Layouts

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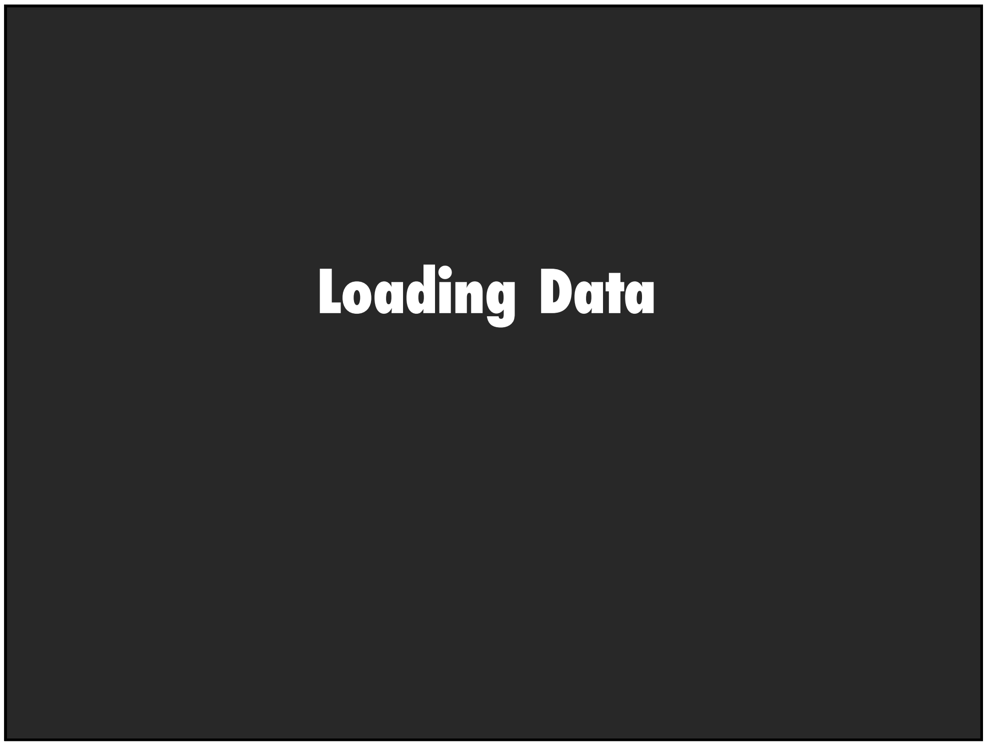
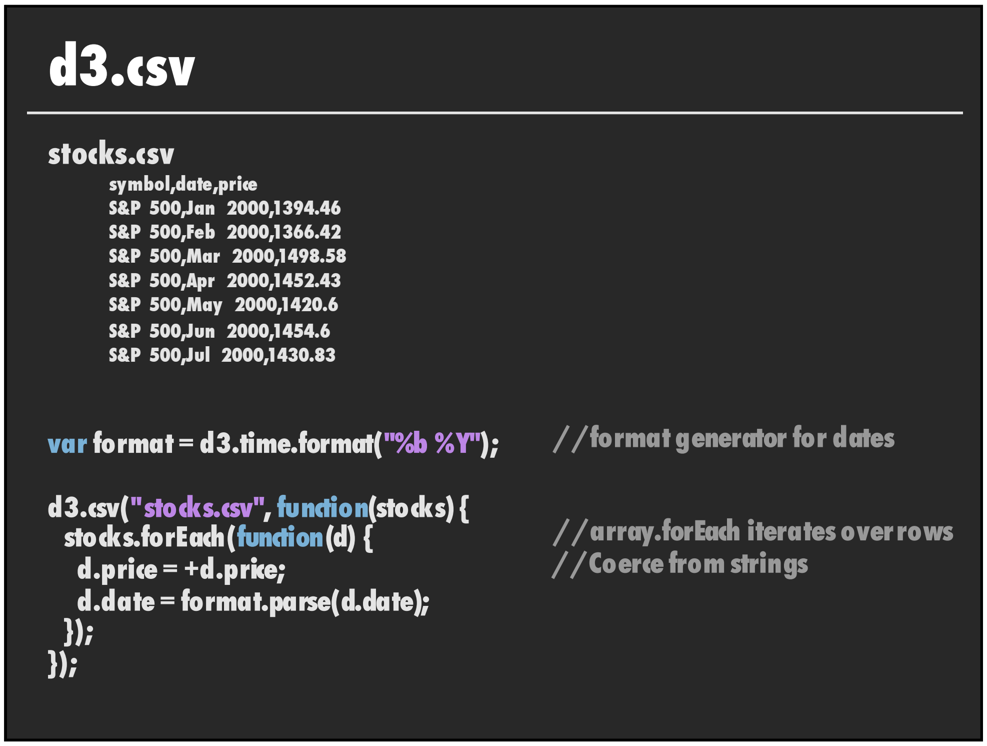
Topics

Loading data
Scales
Axes
Coordinate system
Path generators
Layouts
Interaction

[Some slides adapted from Mike Bostock's D3 Workshop]



Loading Data



d3.csv

stocks.csv

```
symbol,date,price
S&P 500,Jan 2000,1394.46
S&P 500,Feb 2000,1366.42
S&P 500,Mar 2000,1498.58
S&P 500,Apr 2000,1452.43
S&P 500,May 2000,1420.6
S&P 500,Jun 2000,1454.6
S&P 500,Jul 2000,1430.83
```

```
var format = d3.time.format("%b %Y");         //format generator for dates

d3.csv("stocks.csv", function(stocks) {
  stocks.forEach(function(d) {                //array.forEach iterates over rows
    d.price = +d.price;                       //Coerce from strings
    d.date = format.parse(d.date);
  });
});
```

d3.json

stocks.json

```
[{"symbol": "S&P 500", "date": "Jan 2000", "price": 1394.46},
  "symbol": "S&P 500", "date": "Feb 2000", "price": 1366.42},
  "symbol": "S&P 500", "date": "Mar 2000", "price": 1498.58},
  "symbol": "S&P 500", "date": "Apr 2000", "price": 1452.43},
  "symbol": "S&P 500", "date": "May 2000", "price": 1420.6},
  "symbol": "S&P 500", "date": "Jun 2000", "price": 1454.6},
  "symbol": "S&P 500", "date": "Jul 2000", "price": 1430.83}...
```

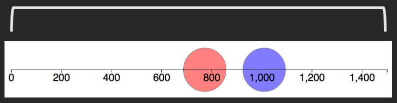
```
var format = d3.time.format("%b %Y");

D3.json("stocks.json", function(stocks) {
  stocks.forEach(function(d) {                //array.forEach iterates over rows
  d.date = format.parse(d.date);
  });
});
```

Scales

Data space → Visual space

```
var x = d3.scale.linear()
       .domain([0, 1500])
       .range([0, w])

//define your own
function x(d) {
  return d * 0.48;
}
```

```
var data = [{name: "A", price: 1009},
            {name: "B", price: 772}];

var w = 960;
```

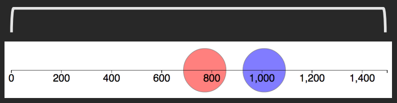


```
var circle = svg.selectAll("circle")
 .data(data)
 .enter()
 .append("circle")
   .attr("cx", function(d)  { return x(d.price);   })
   .attr("cy", 0)
   .attr("r", 50)
   .style("stroke", "black")
   .style("fill", function(d) { return col(d.name);})
   .style("opacity", 0.5);
```

Ordinal mappings

```
var col = d3.scale.ordinal()
    .domain(["A", "B"])
    .range(["blue", "red"]);
```

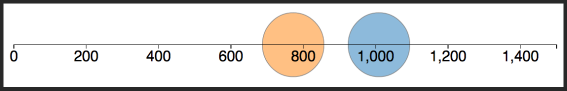
```
var data = [{name: "A", price: 1009},
            {name: "B", price: 772}];

var w = 960;
```



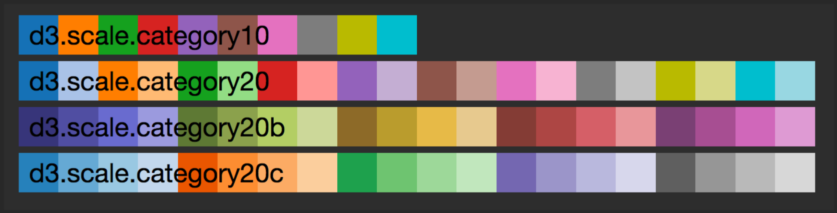
```
var circle = svg.selectAll("circle")
 .data(data)
 .enter()
 .append("circle")
   .attr("cx", function(d)  { return x(d);   })
   .attr("cy", 0)
   .attr("r", 50)
   .style("stroke", "black")
   .style("fill", function(d) { return col(d.name);})
   .style("opacity", 0.5);
```

Categorical mappings

```
var col = d3.scale.category10()
   .domain(["A", "B"]);
```



```
var col = d3.scale.ordinal()
   .range(colorbrewer.Set1[9]]);
```

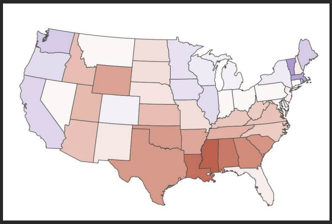


Interpolators (quantitative scales)

```
var col = d3.scale.linear()
   .domain([12, 24])
   .range(["steelblue", "brown"]);

col(16); //#666586
```

```
var x = d3.scale.linear()
   .domain([12, 24])
   .range(["0px", "720px"]);

x(16); //240px
```

Diverging scale

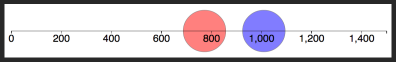


```
var col = d3.scale.linear()
   .domain([0, 50, 100])
   .range(["blue", "white", "red"]);
```

Axes

Creating and rendering an axis

```
var x = d3.scale.linear()
      .domain([0, 1500])
      .range([0, w])
```



Define axis element

```
var xAxis = d3.svg.axis()
     .scale(x);
```

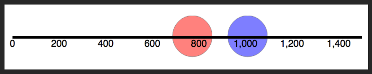
Render by calling a <g> selection

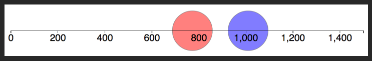
```
svg.append("g")
  .attr("class", "x axis")
  .call(xAxis);
```

Creating and rendering an axis

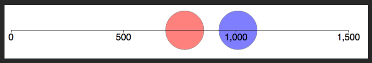
Customize using CSS

```
.axis path, .axis line {
  fill: none;
  stroke: #000;
  shape-rendering: crispEdges;
}
```



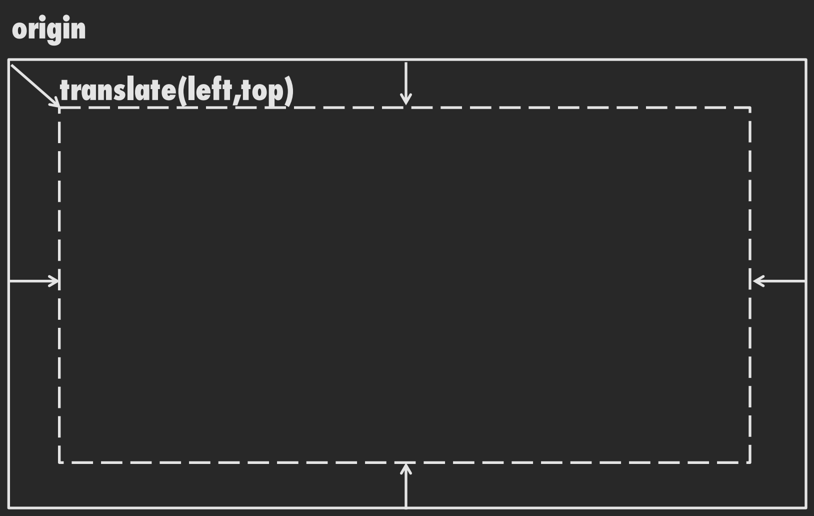


```
var xAxis = d3.svg.axis()
    .scale(y)
    .ticks(4);
```



SVG Coordinate System

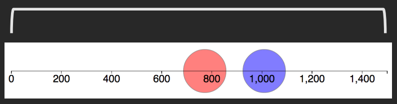
SVG Coordinates



Use transforms on <g> to define a new origin (e.g., plotting area)

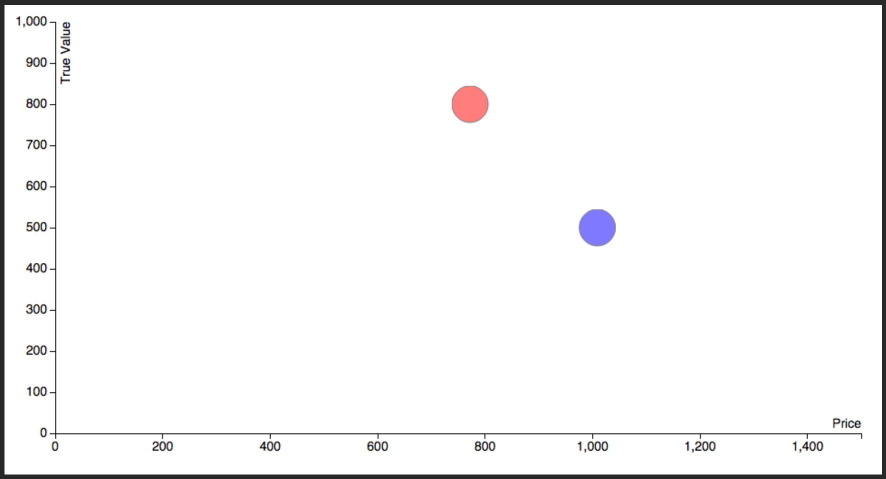
Axis example

```
var data = [{name: “A”, price: 1009};Value: 500},
            {name: “B”, price: 772}];Value: 900}];
      var w = 960;
```

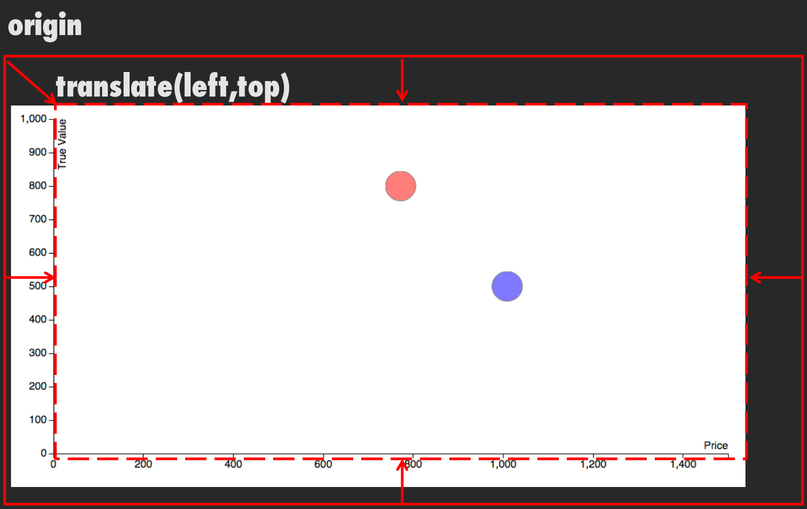


```
var x = d3.scale.linear()
      .domain([0, 1500])
      .range([0, w])

var circle = svg.selectAll("circle")
 .data(data)
 .enter()
 .append("circle")
   .attr("cx", function(d) { return x(d); })
   .attr("cy", 0)
   .attr("r", 50)
   .style(“stroke”, “black”)
   .style("fill", function(d) { return col(d.name);})
   .style("opacity", 0.5);
```

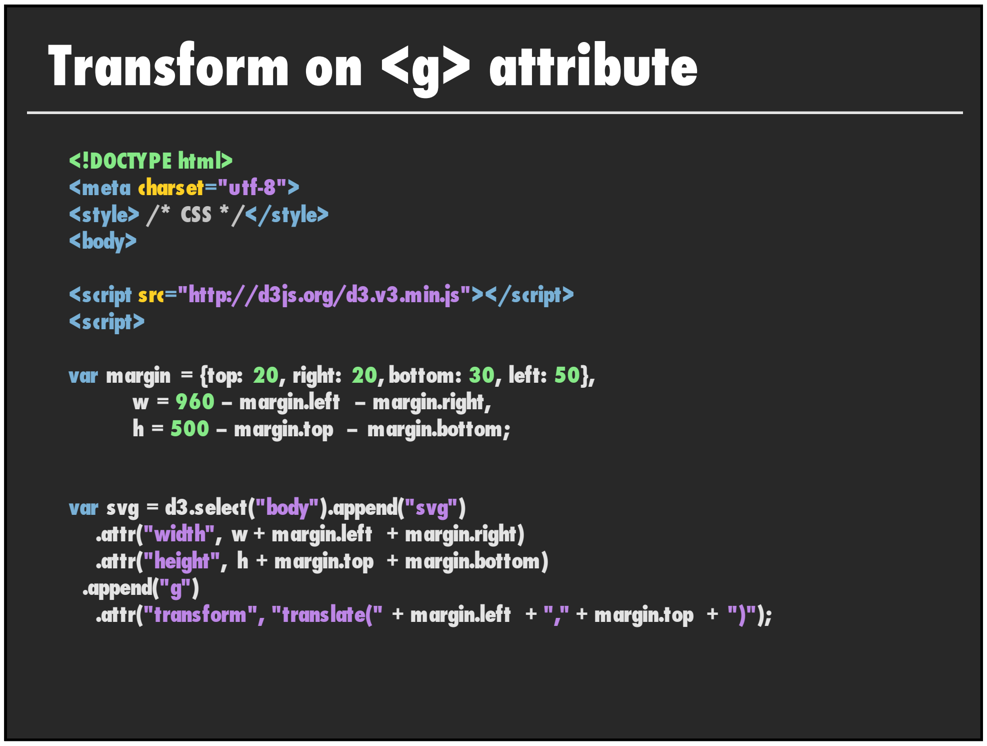
```
var xAxis = d3.svg.axis()
      .scale(x);

svg.append(“g”)
   .attr(“class”, “x axis”)
   .call(xAxis);
```



Transform on <g> attribute

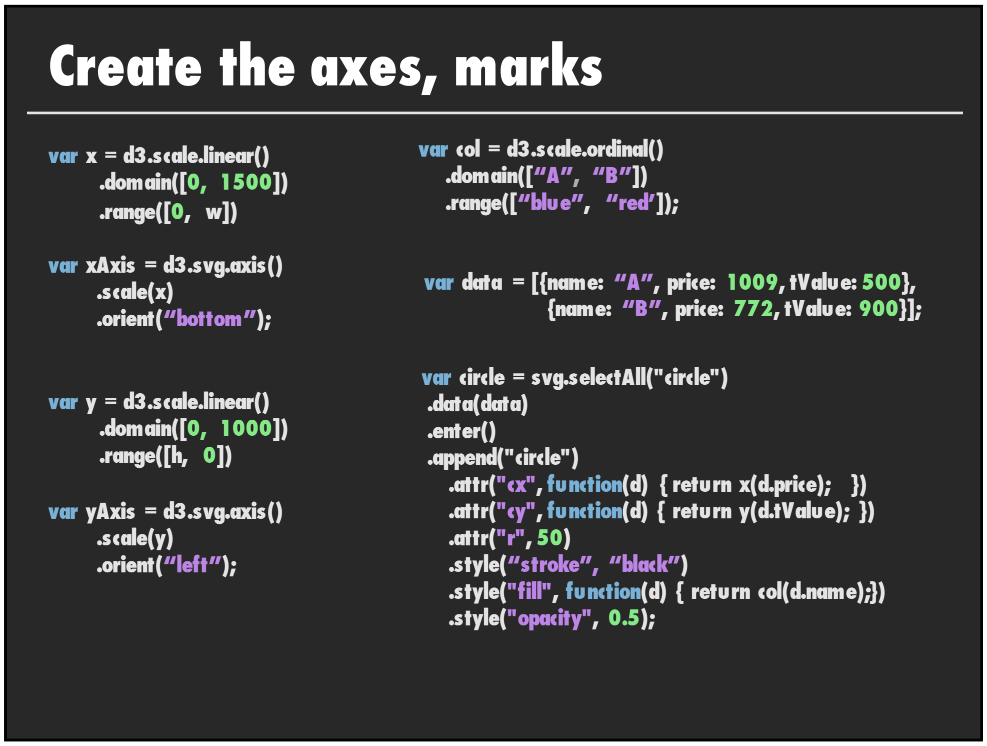


Define a new origin for plotting area
Axes appear in margin



Transform on <g> attribute

```
<!DOCTYPE html>
<meta charset="utf-8">
<style> /* CSS */</style>
<body>

<script src="http://d3js.org/d3.v3.min.js"></script>
<script>

var margin = {top: 20, right: 20, bottom: 30, left: 50},
         w = 960 – margin.left – margin.right,
         h = 500 – margin.top – margin.bottom;


var svg = d3.select("body").append("svg")
    .attr("width", w + margin.left + margin.right)
    .attr("height", h + margin.top + margin.bottom)
  .append("g")
    .attr("transform", "translate(" + margin.left + "," + margin.top + ")");
```



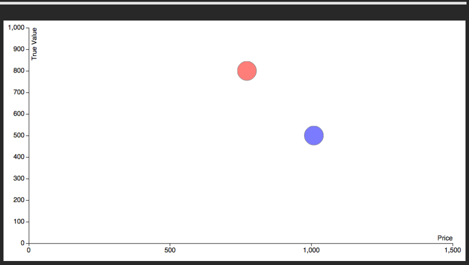
Create the axes, marks

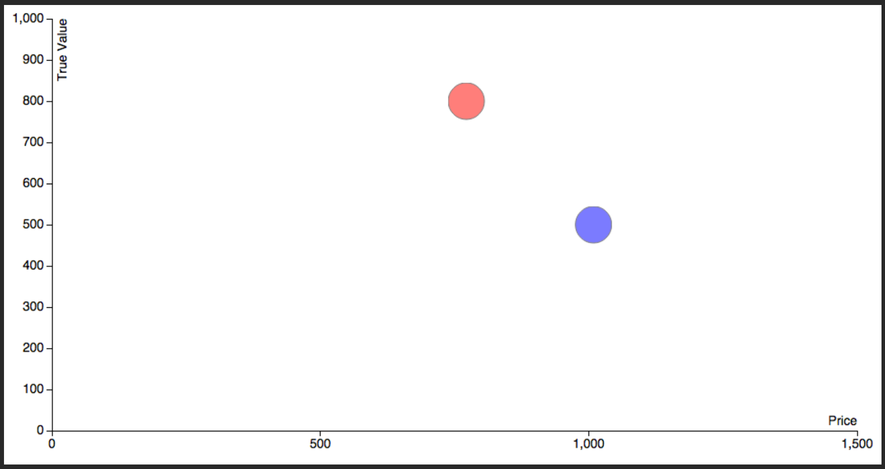
```
var x = d3.scale.linear()
       .domain([0, 1500])
       .range([0, w])

var xAxis = d3.svg.axis()
       .scale(x)
       .orient(“bottom”);


var y = d3.scale.linear()
       .domain([0, 1000])
       .range([h, 0])

var yAxis = d3.svg.axis()
       .scale(y)
       .orient(“left”);
```

```
var col = d3.scale.ordinal()
    .domain([“A”, “B”])
    .range([“blue”, “red’]);


var data = [{name: “A”, price: 1009, tValue: 500},
                 {name: “B”, price: 772, tValue: 900}];


var circle = svg.selectAll("circle")
 .data(data)
 .enter()
 .append("circle")
    .attr("cx", function(d) { return x(d.price); })
    .attr("cy", function(d) { return y(d.tValue); })
    .attr("r", 50)
    .style(“stroke”, “black”)
    .style("fill", function(d) { return col(d.name);})
    .style("opacity", 0.5);
```

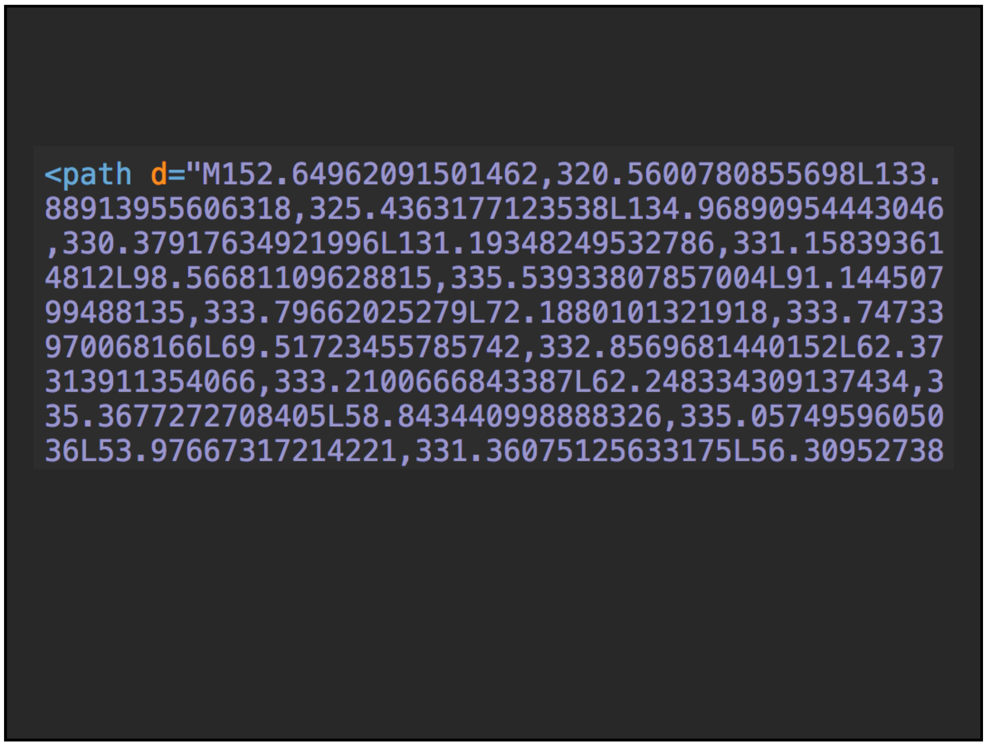
Add the axes

```
svg.append("g")
        .attr("class", "x axis")
        .attr("transform", "translate(0," + h + ")")
        .call(xAxis)
    .append("text")
        .attr("class", "label")
        .attr("x", w)
        .attr("y", -6)
        .style("text-anchor", "end")
        .text("Price");

svg.append("g")
        .attr("class", "y axis")
        .call(yAxis)
    .append("text")
        .attr("class", "label")
        .attr("transform", "rotate(-90)")
        .attr("y", 6)
        .style("text-anchor", "end")
        .text("True Value");
</script>
```





Path Generators

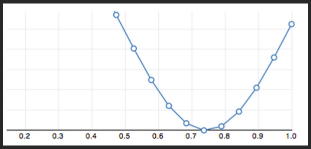


```
<path d="M152.64962091501462,320.5600780855698L133.
88913955606318,325.4363177123538L134.96890954443046
,330.37917634921996L131.19348249532786,331.15839361
4812L98.56681109628815,335.53933807857004L91.144507
99488135,333.79662025279L72.1880101321918,333.74733
970068166L69.51723455785742,332.8569681440152L62.37
313911354066,333.2100666843387L62.248334309137434,3
35.3677272708405L58.843440998888326,335.05749596050
36L53.97667317214221,331.36075125633175L56.30952738
```

d3.svg.line

Path defined by *x* and *y*

```
var x = d3.scale.linear(),
    y = d3.scale.linear();

var line = d3.svg.line()
   .x(function(d) { return x(d.x); })
   .y(function(d) { return y(d.y); });
```



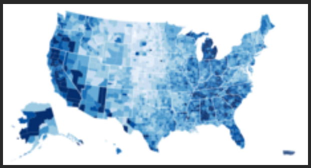
Linear, step, and basis interpolation

d3.geo.path

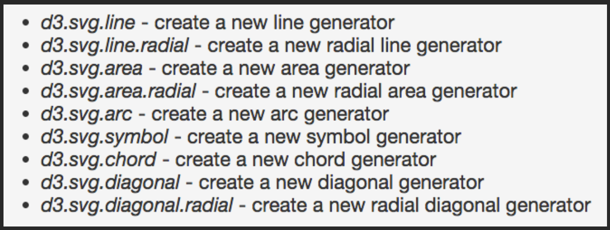
Like d3 line

GeoJSON/TopoJSON format

```
var projection = d3.geo.albersUsa()
   .scale(1280)
   .translate([width / 2, height / 2]);

var path = d3.geo.path()
   .projection(projection);
```



Other path generators

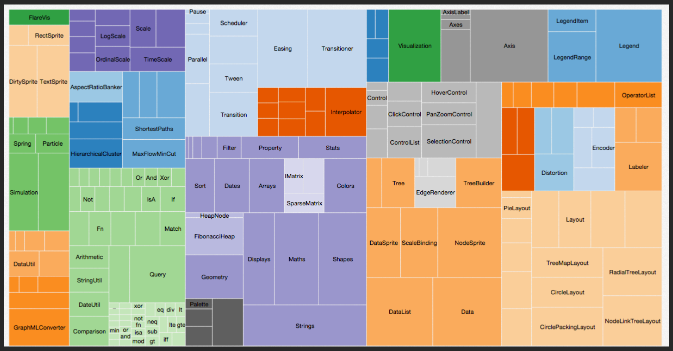


- *d3.svg.line* - create a new line generator
- *d3.svg.line.radial* - create a new radial line generator
- *d3.svg.area* - create a new area generator
- *d3.svg.area.radial* - create a new radial area generator
- *d3.svg.arc* - create a new arc generator
- *d3.svg.symbol* - create a new symbol generator
- *d3.svg.chord* - create a new chord generator
- *d3.svg.diagonal* - create a new diagonal generator
- *d3.svg.diagonal.radial* - create a new radial diagonal generator

Layouts

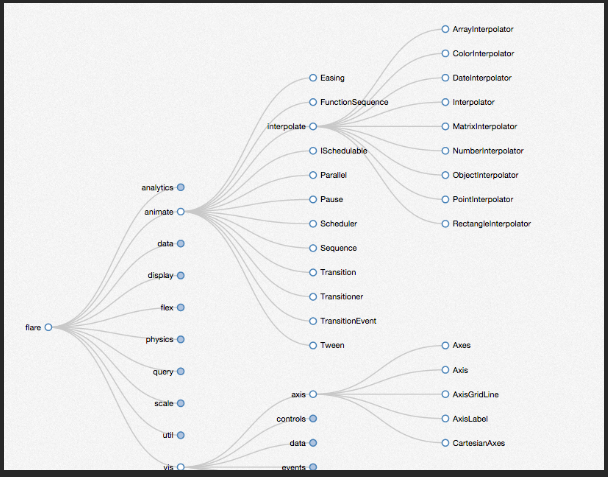
Hierarchical layouts

```
var treemap = d3.layout.treemap()
    .padding(4)
    .size([width, height]);

var parent = {"children": […]},
    child = {"value": …};
```



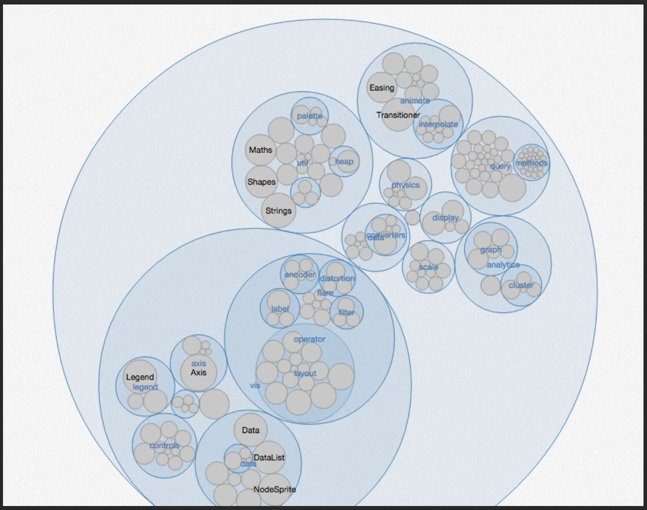
Hierarchical layouts

d3.layout.tree



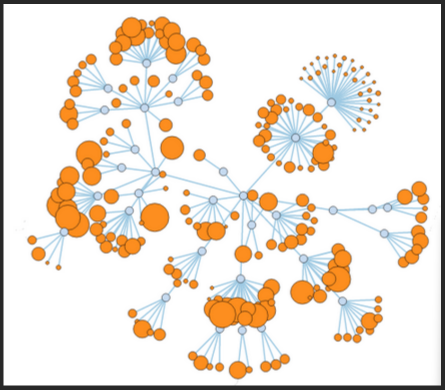
Hierarchical layouts

d3.layout.pack



Network layout

d3.layout.force



Interaction in D3

Write functions to update the visualization on mouse events

```
var circle = svg.selectAll("circle")
 .data(data)
 .enter()
 .append("circle")
   .attr("cx", function(d)  { return x(d.price);   })
   .attr("cy", function(d)  { return y(d.tValue); })
   .attr("r", 50)
   .style("stroke", "black")
   .style("fill", function(d) { return col(d.name);})
   .style("opacity", 0.5)
   .on("mouseover", function(d,i){  showLabel(i);  })
   .on("mouseout", function(d,i){  hideLabel(i);  });
```

CSS can simplify simple interactions

```
.circle:hover  {
  fill: yellow;
}
```

Interaction Resources for D3

Use HTML inputs or JavaScript widgets as needed

- e.g., http://www.d3noob.org/2014/04/using-html-inputs-with-d3js.html

See d3.behaviors for drag and zoom

- **Zoom example:** http://bl.ocks.org/mbostock/9656675
- **Drag + zoom:** http://bl.ocks.org/mbostock/6123708

Use transition() for smooth animations between states

- http://blog.visual.ly/creating-animations-and-transitions-with-d3-js/

```
circle.transition()
   .attr("r",40)
   .duration(1000)
   .delay(100)
```