CMPT 384 – Information Visualization

D3.js

Lab 8

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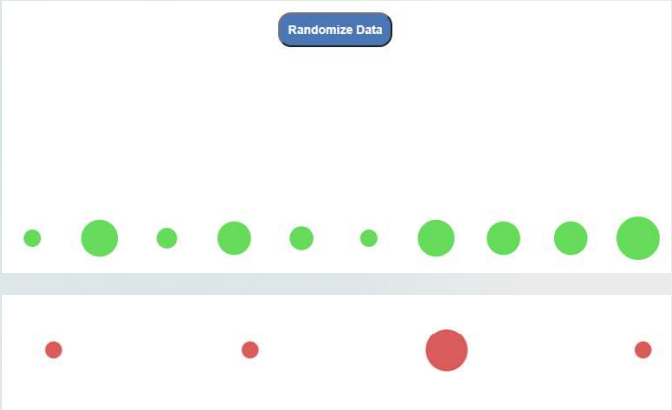
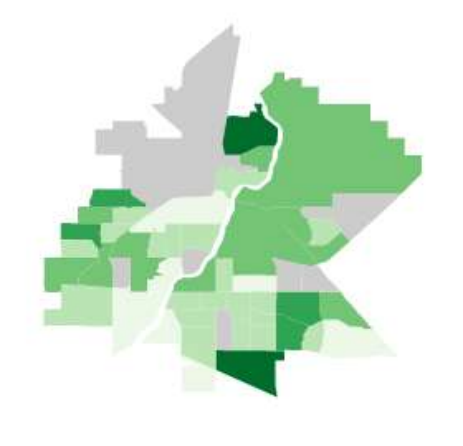
Agenda

- D3 Geographic Map (Saskatoon)
- D3 Enter, Update and Exit
- D3 Zoom





Finding the Right GEOJSON

LIST OF MOST NORTH AMERICAN CITIES AND PROVINCES -
https://github.com/codeforamerica/click_that_hood/tree/master/public/data

CONVERT PUBLICLY AVAILABLE SHAPE FILES INTO GEOJSON -
http://geojson.io/#map=2/20.0/0.0

Finding the Right Data

OPEN-DATA Websites –

- http://www.opendatask.ca/data/ - Curated List of all data on saskatoon available for free
- http://opendata-saskatoon.cloudapp.net/ - Catalogue of Saskatoon open data
- https://data.calgary.ca/ - Calgary open data

D3 Maps – Centering Projection

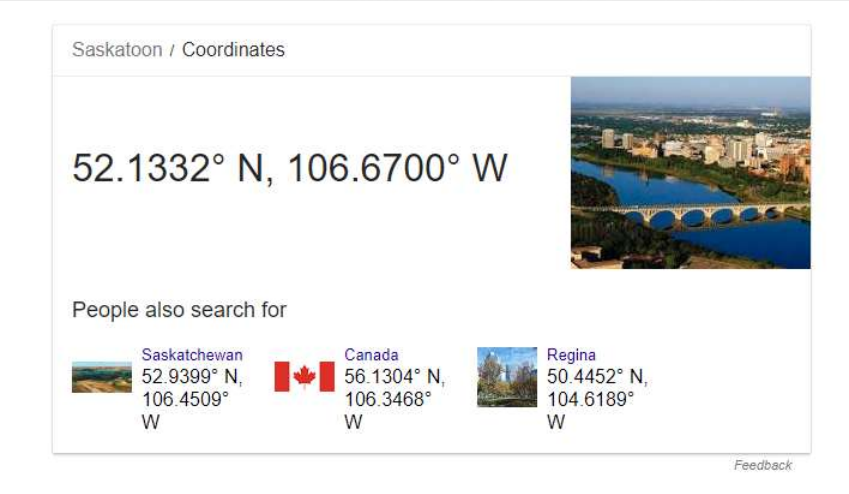
```
//Define map projection
var projection = d3.geoMercator()
    .center([-106.67, 52.1332])
    .translate([w / 2, h / 2])
    .scale([50000]);
```

Since we are looking at a city scale the projection to a higher value thus zooming into the map.

The default is 1000 for a world level overview.

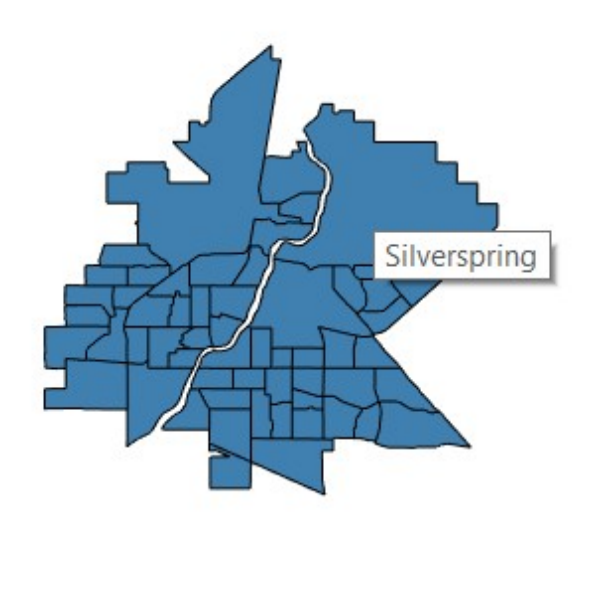
Since saskatoon is to the west of the Prime (Greenwich) meridian , the value is negative.

Similarly a latitude south of the Equator would be negative



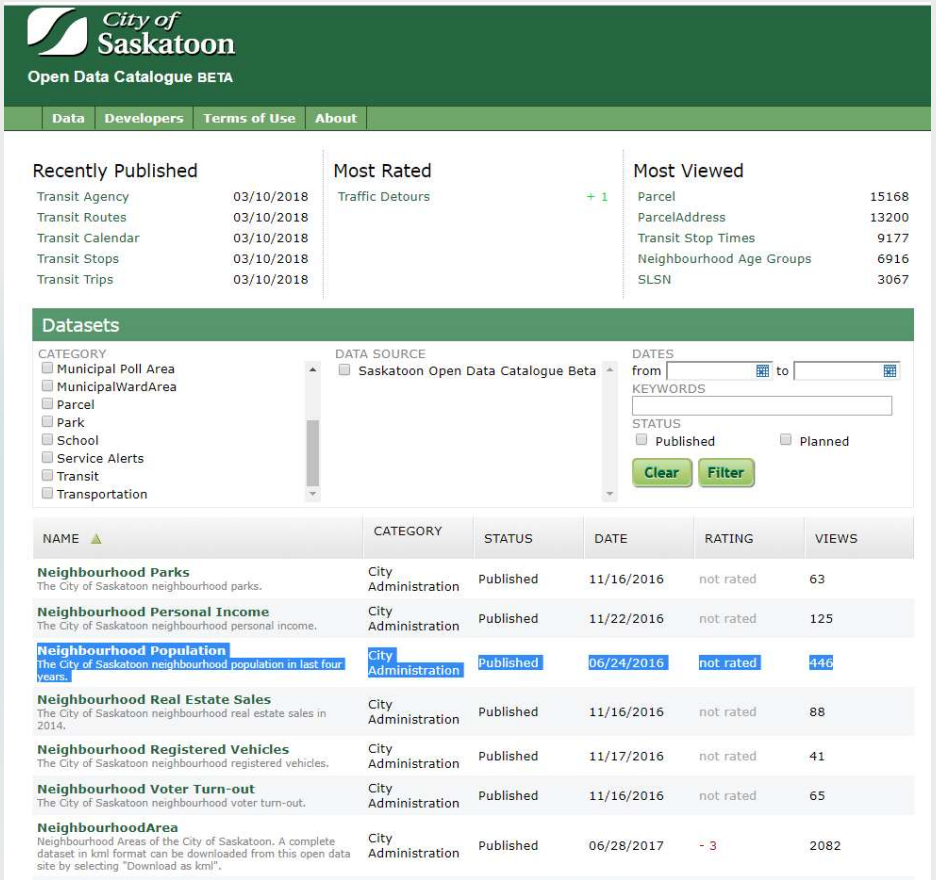
Text on Mouse Hover

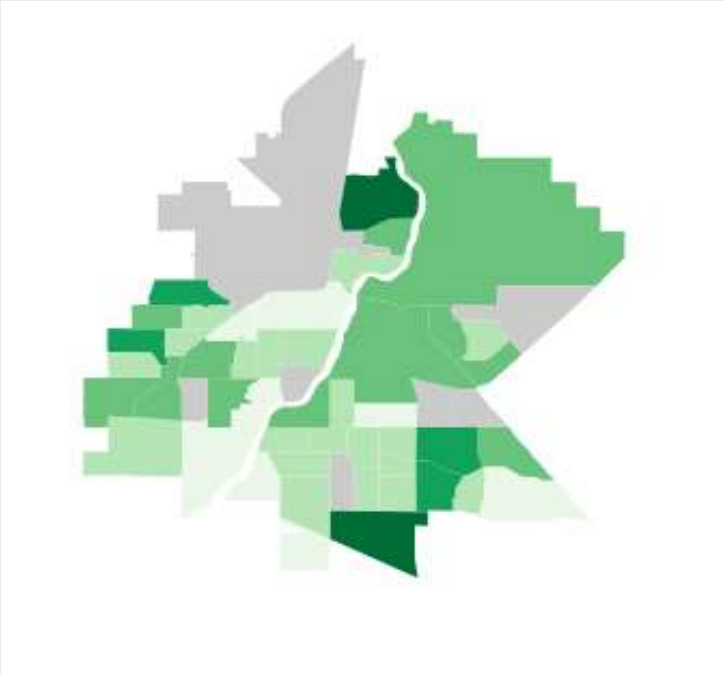
```
//Load in GeoJSON data
d3.json("saskatoon.json").then(function(json) {

    //Bind data and create one path per GeoJSON feature
    svg.selectAll("path")
        .data(json.features)
        .enter()
        .append("path")
        .attr("d", path)
        .attr('fill', 'steelblue')
        .attr('stroke', 'black')
        .append('title')
        .text(function(d) {
            return d.properties.name;
        })

});
```



Title is SVG's way of creating a tooltip , the way this looks however can be dependent on the browser .

Merging Data with Maps





Example 2 – Map Saskatoon – Population for 2015

D3 : Enter - Update - Exit Pattern

0. Initial

```
<svg width="800" height="400"></svg> == $0
```

1. Enter

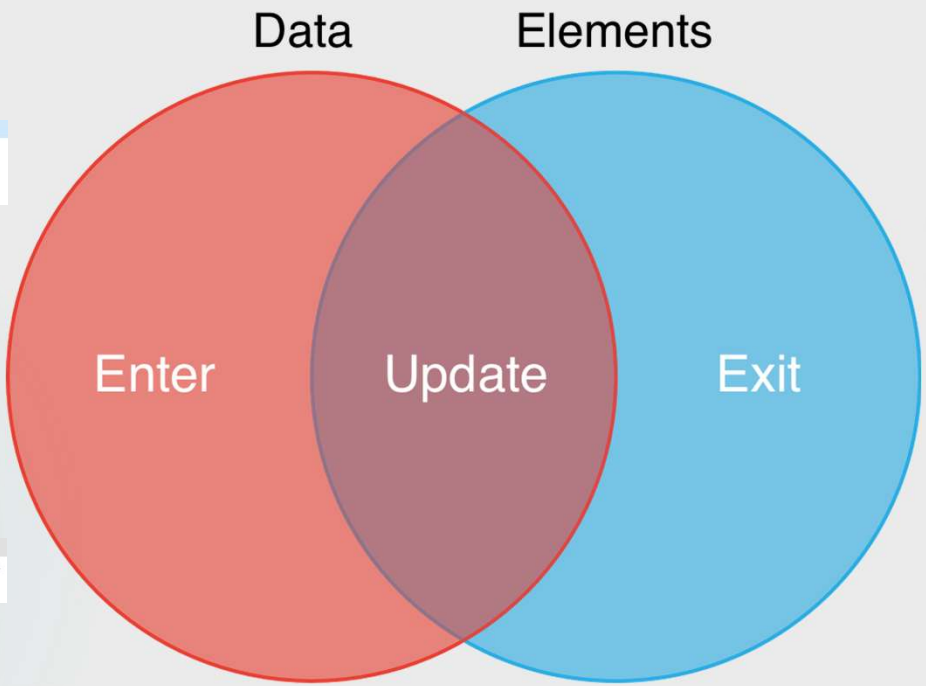
```
<svg width="800" height="400"> == $0
  <circle cx="50" cy="200" fill="rgb(219, 92, 92)" r="25"></circle>
  <circle cx="750" cy="200" fill="rgb(219, 92, 92)" r="10"></circle>
</svg>
```

2. Update + Enter

```
<svg width="800" height="400"> == $0
  <circle cx="50" cy="200" fill="rgb(219, 92, 92)" r="25"></ci
  <circle cx="400" cy="200" fill="rgb(219, 92, 92)" r="25"></c
  <circle cx="750" cy="200" fill="#66db5c" r="10"></circle>
</svg>
```

3. Update + Exit

```
<svg width="800" height="400"> == $0
  <circle cx="50" cy="200" fill="rgb(219, 92, 92)" r="10"></circle>
</svg>
```




```
var svg = d3.select('body')
            .append('svg')

svg.selectAll('circle')
   .data(dataset)
```

0. dataset = []
1. dataset = [25, 10]
2. dataset = [25, 25, 10]
3. dataset = [10]

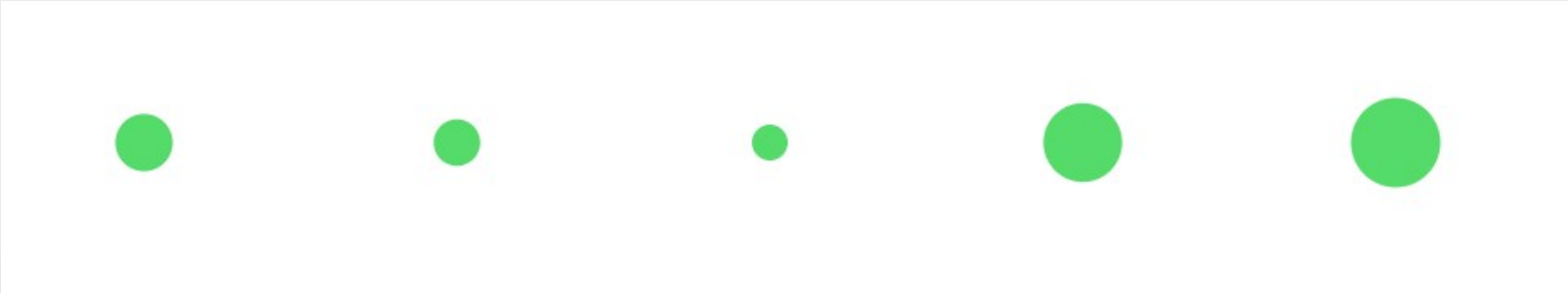
Reference - https://www.smashingmagazine.com/2018/02/react-d3-ecosystem/

3 Scenarios on Data Update

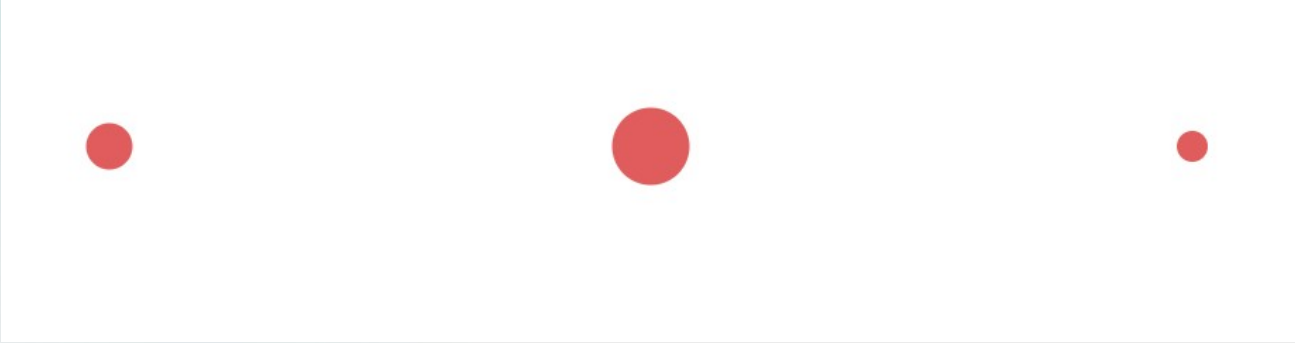
- The initial dataset and the next dataset have the same number of datapoints – Update the elements with new attributes
- The next dataset has more elements – Enter + Update , create new elements and update existing ones with new attributes
- The next dataset has fewer elements – Exit + Update , Remove elements that no longer exist in the new dataset and update the remaining ones

EXIT + UPDATE PATTERN

INITIAL DATASET - [3, 2, 1, 5, 6]

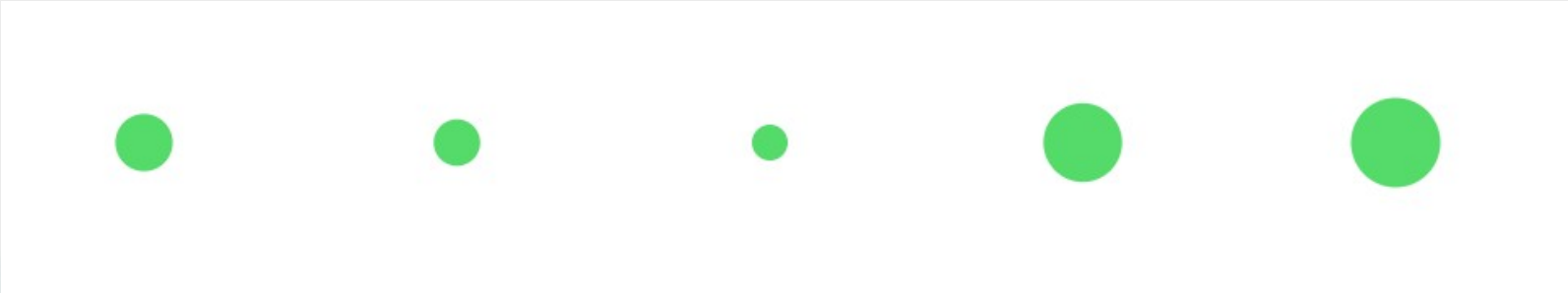


NEXT DATASET - [4,3,1]

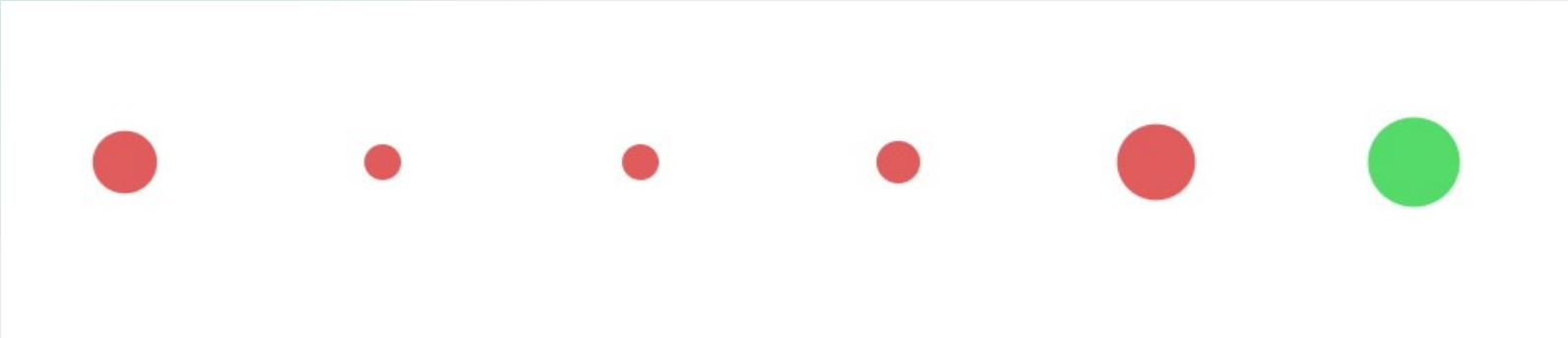


ENTER + UPDATE PATTERN

INITIAL DATASET - [3, 2, 1, 5, 6]



NEXT DATASET - [5, 1, 1, 2, 7, 9]



Random Array Generator

```
// Returns a random number between 1 to 10
function getRandomNumber() {
    // random returns a value in decimal between 0 and 1 , so we multiply it by 10
    // to get one digit and then ceil the value to the nearest number
    // so if random returns 0.5688 , it becomes 5.688 after multiplying with 10
    // and then is ceiled to 6
    return Math.ceil(Math.random() * 10);
}

// Returns a array having random numbers between 1 to 10
function getRandomArray(length) {
    // create empty array
    var dataArray = new Array(length);
    // Fill the content with random numbers
    for (var i = 0; i < length; i++) {
        dataArray[i] = getRandomNumber();
    }
    return dataArray;
}
```

```
> getRandomNumber()
<· 6
> getRandomArray(5)
<· ▶ (5) [9, 3, 8, 1, 7]
> getRandomArray(4)
<· ▶ (4) [8, 1, 9, 5]
> getRandomArray(2)
<· ▶ (2) [6, 1]
>
```

Pass Random Data on Click

```
//Create SVG element
var svg = d3.select("body")
    .append("svg")
    .attr("width", w)
    .attr("height", h);

// Call the function the first time for an intial set of 10 circles
// Since all the circles are new , they will be all green
updateCircles(10);

// Attach a click function to the button
// Each time the button is clicked we call the updateCircles function
// with a random number generated on the fly
d3.select('button').on("click", function() {
    var randomArrayLength = getRandomNumber();
    updateCircles(randomArrayLength);
});
```

Create Scales for X position and Radius

```
// xScale to get the x position of the circles
// evenly distributed in the available width
var xScale = d3.scaleLinear()
    .domain([0, dataset.length - 1])
    // 50 pixels padding on both sides
    .range([50, w - 50]);

// Size scale so the numbers in range of 1 to 10 are converted
// into range of 10 to 25 pixels for setting radius of the circles
var sizeScale = d3.scaleLinear()
    .domain([d3.min(dataset), d3.max(dataset)])
    .range([10, 25]);
```

JOIN Data

Get all the circles on the webpage and merge them with the new dataset

```
// JOIN - Join the data to the circles
var circles = svg.selectAll('circle')
    .data(dataset);
```

Exit Data

Remove circles that are no longer needed smoothly by taking them to the bottom of the screen and also reducing their size via transition

```
// EXIT - Circles that are no longer in the dataset
circles
    .exit()
    .transition()
    .duration(500)
    .attr('r', 0)
    .attr('cy', h)
    .remove();
```

Update Elements

```
// UPDATE  - Circles that are in the dataset but have different values
circles
    .transition()
    .duration(500)
    .attr('r', function(d) {
        return sizeScale(d);
    })
    .attr("cx", function(d, i) {
        return xScale(i);
    })
    .attr('fill', '#db5c5c')
```

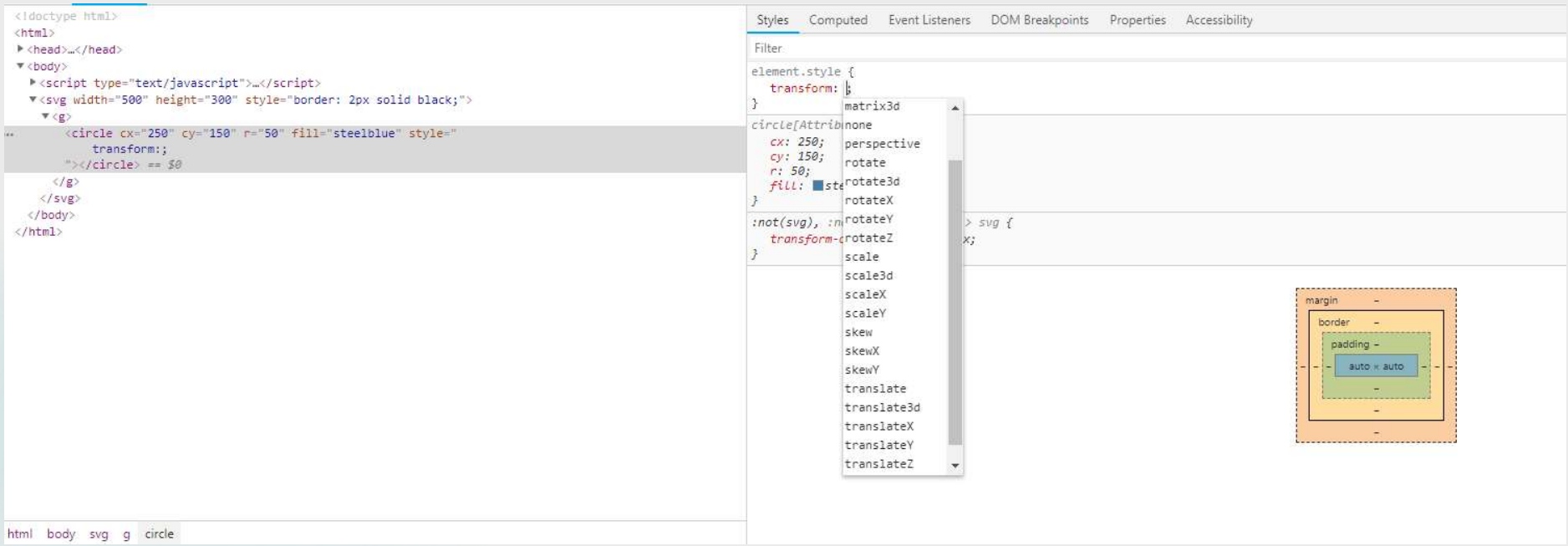
ENTER – New Elements

```
// ENTER - New circles that need to be added
circles
    .enter()
    .append('circle')
    .attr("cx", function(d, i) {
        return xScale(i);
    })
    .attr("cy", 0)
    .attr('fill', '#66db5c')
    .attr("r", "0")
    .transition()
    .duration(500)
    .attr('r', function(d) {
        return sizeScale(d);
    })
    .attr("cy", h / 2)
```

New Circles are created as dots on the top of the page which is why the cy and radius are initially set to 0

Then they transition to their correct places also while increasing in size to their actual radius.

SVG Transform Property



For zoom effect we will use a mixture of Scale and Translate .
Scale creates the actual zooming while Translate is for panning the zoomed image so the zooming is happening with respect to the mouse cursor position

D3 – Zoom

```
//Create SVG element
var svg = d3.select("body")
    .append("svg")
    .attr("width", w)
    .attr("height", h)
    // create a border around the svg so the user has a reference perspective
    // when zooming or panning the chart
    .style('border', '2px solid black')
```

Initial SVG given black border so user has a reference container while zooming and panning the chart

```
// We are attaching the zoom to the svg but the actual zooming happens on the inner container
//  this way we dont zoom the actual object we are observing for zoom events

// Create an inner g element inside the svg
// and create a circle inside that
var innerGraphicContainer = svg.append('g');

innerGraphicContainer.append('circle')
    .attr('cx', '250')
    .attr('cy', '150')
    .attr('r', '50')
    .attr('fill', 'steelblue');
```

Attaching the Zoom Callback

```
var attachZoom = d3.zoom().on('zoom', function(d) {
    d3.select('g').attr('transform', d3.event.transform);
})

//Create SVG element
var svg = d3.select("body")
    .append("svg")
    .attr("width", w)
    .attr("height", h)
    // create a border around the svg so the user has a reference perspective
    // when zooming or panning the chart
    .style('border', '2px solid black')
    // To the svg attach the zoom function
    // When a call function is called on an object , the object is passed as an argument
    // to the function being called , so in this case the object is the svg and the function
    // being called in the zoom function
    // so zoom function is attached to the svg
    .call(attachZoom);
```