

A detailed close-up photograph of a mechanical watch movement, showing various brass gears, a large circular component at the top, and intricate metalwork. The image has a warm, golden-brown color palette.

TIME

FOR SOME NEW GRAPHS

**Incorporating Time Elements and Interactivity
into your Web App Visualizations**


David Mann

Biogen Idec

TOPICS

- **Why bother?**
- **Animation**
- **Time**
- **Interactivity**
- **Design**
- **Implementation - Tools and Concepts**
- **Demos**

BIO

- **Graphic Arts Background**
- **Development Background**
- **Lead Oracle DBA for**  **biogen idec**
- **I make unpleasing sequences of 0s and 1s into pleasing sequences of 0s and 1s**



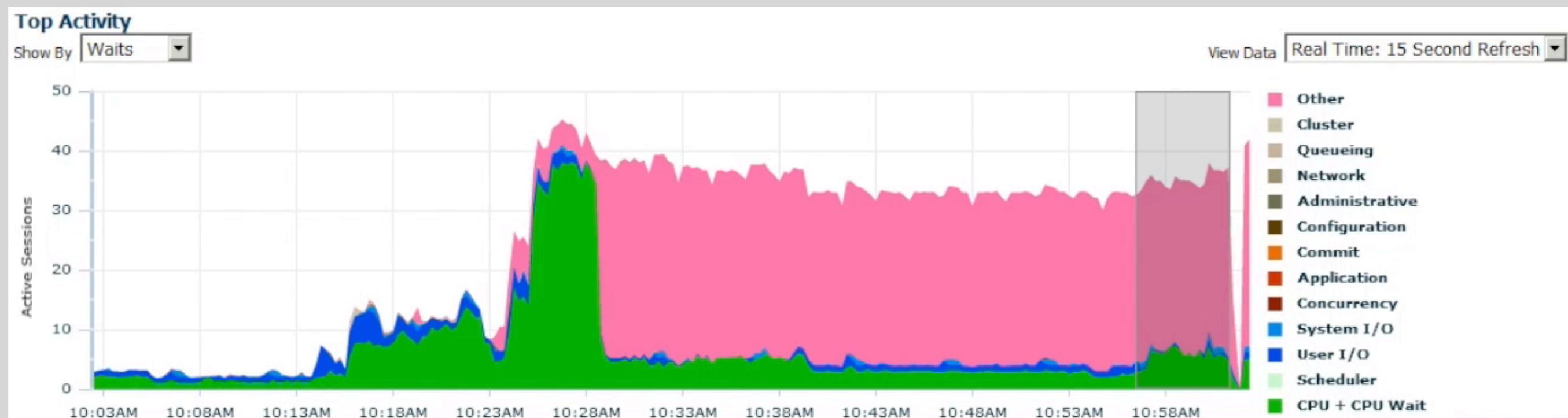
WHY BOTHER?

REALLY, WHY?

- **Useful to users**
- **New insights into data - curiosity**
- **Boss said so**
- **Expressiveness**
- **Tell a story**
- **Unique, Standout**

MOTIVATION

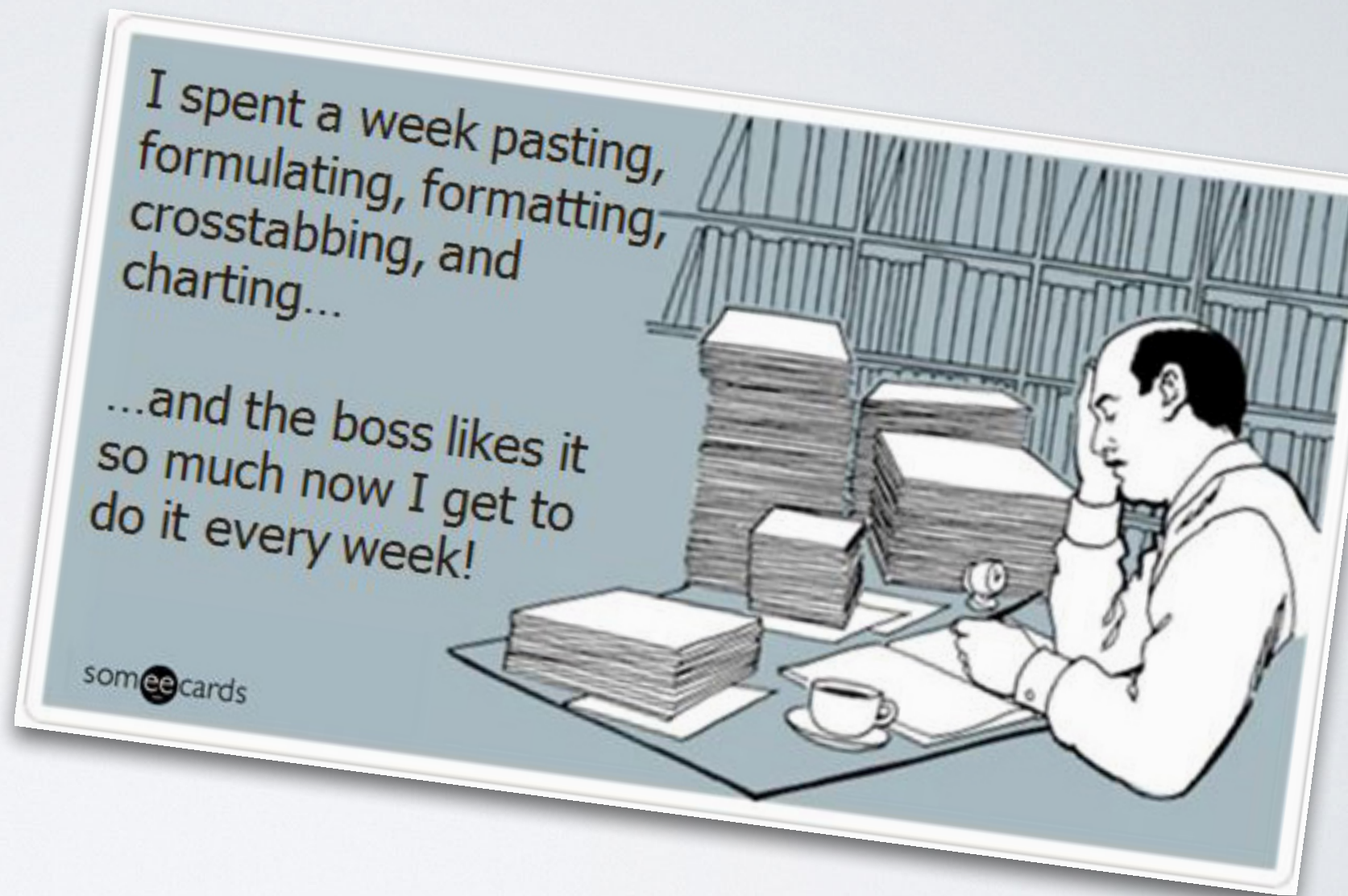
What is mine?



What is yours?

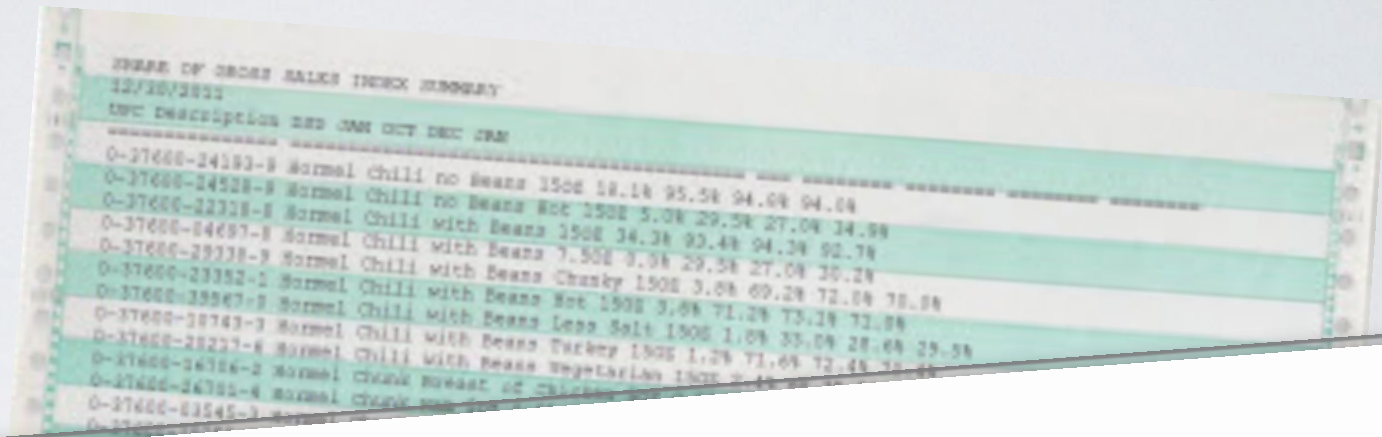
AUDIENCE

- Operational
- Power Users
- Executive Summaries



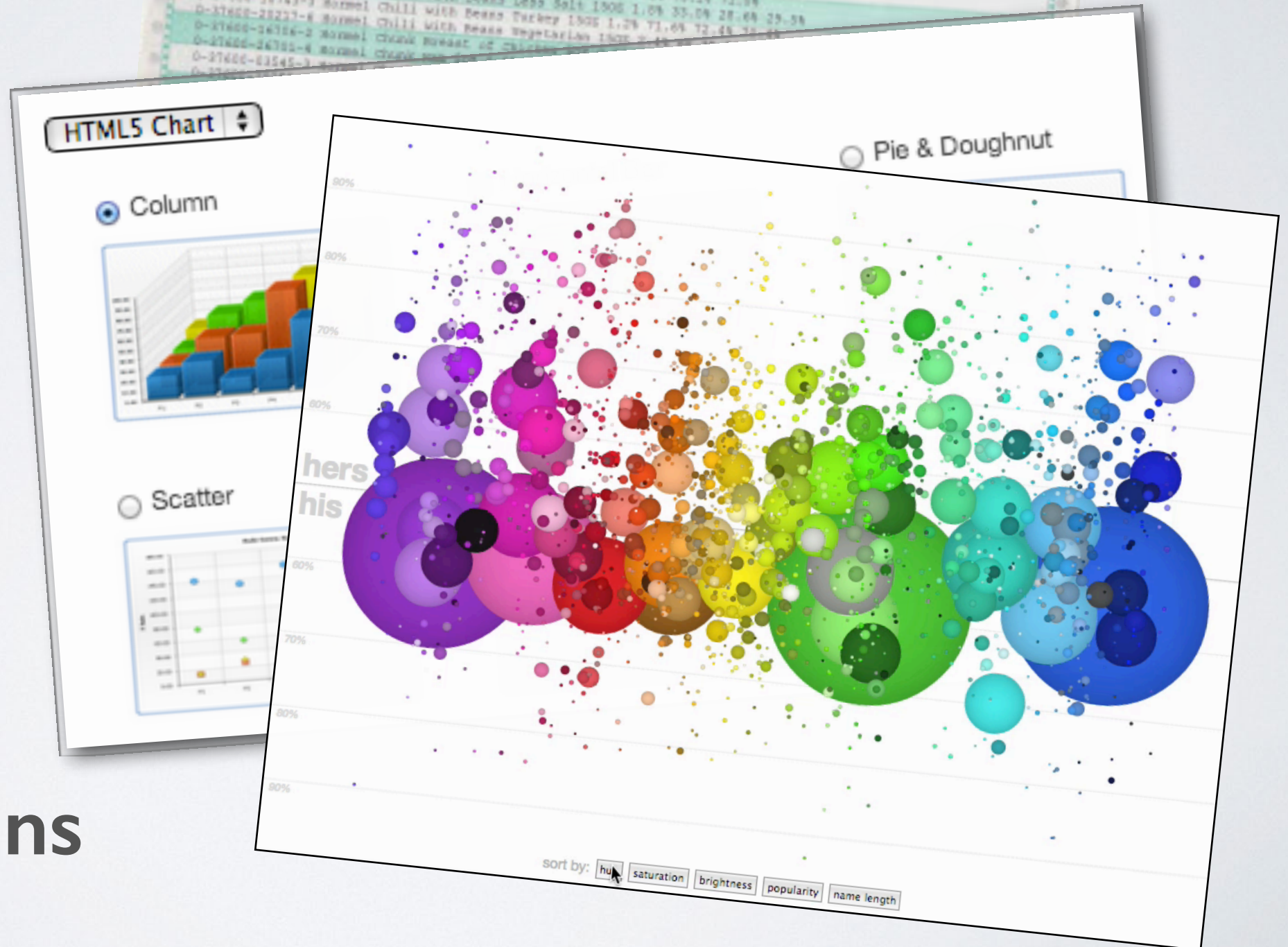
EVOLUTION

- Text Reports



ITEM DESCRIPTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
0-37600-24193-8 Normal Chili no Beans 150g	18.18	95.58	94.68	94.68									
0-37600-24528-8 Normal Chili no Beans Hot 150g	5.08	29.58	27.08	24.98									
0-37600-22328-8 Normal Chili with Beans 150g	34.38	93.48	94.38	92.78									
0-37600-24697-8 Normal Chili with Beans 150g	7.58	9.08	29.58	27.08	20.28								
0-37600-29338-8 Normal Chili with Beans Chunky 150g	3.08	69.28	72.88	78.88									
0-37600-23352-1 Normal Chili with Beans Hot 150g	3.08	71.28	73.28	72.88									
0-37600-29967-8 Normal Chili with Beans Less Salt 150g	1.08	33.08	28.68	29.58									
0-37600-28743-3 Normal Chili with Beans Turkey 150g	1.28	71.68	72.48	78.88									
0-37600-24386-2 Normal Chunky Sausage 150g													
0-37600-24386-2 Normal Chunky Sausage 150g													
0-37600-22545-3 Normal Chunky Sausage 150g													

- Graphs

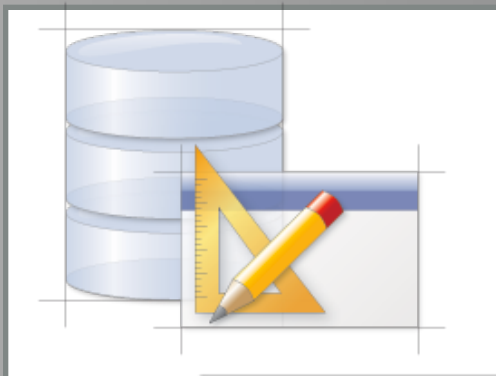


- Visualizations

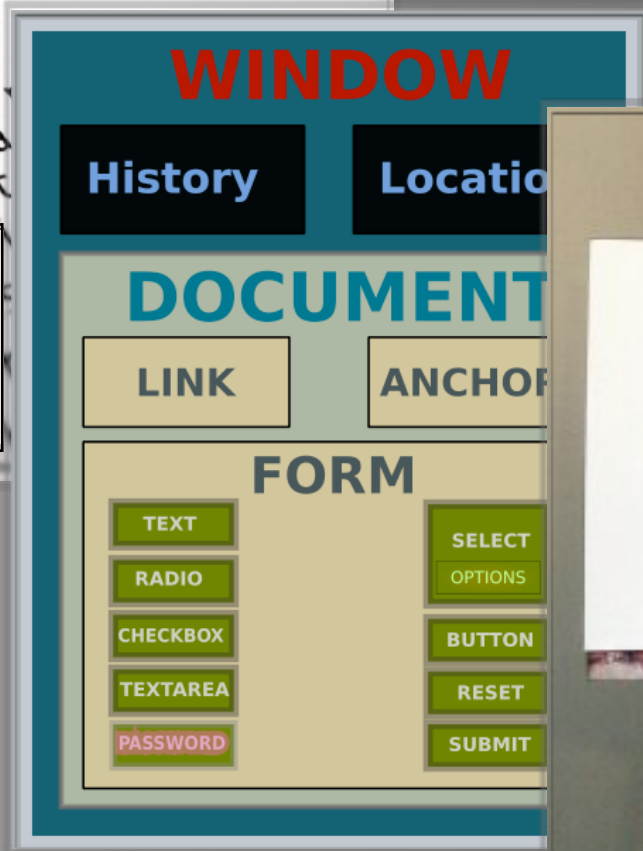

VISUALIZATION PROGRESS

- Static graphic
- Animated exposition
- Pan/zoom exploration
- Interactive Filtering and Refresh
- Add data in Real Time and Refresh
- Advanced interactivity

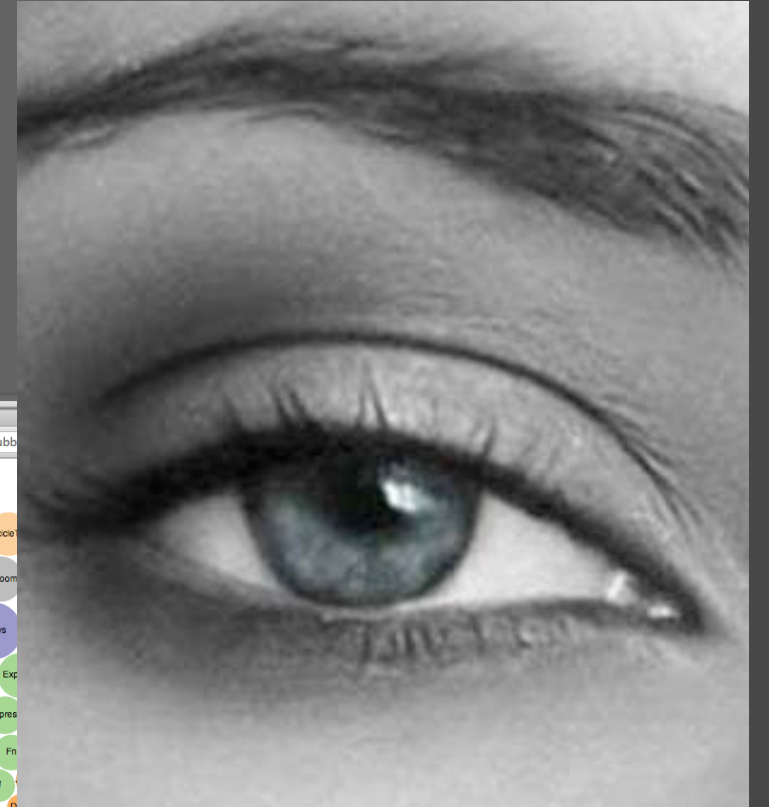
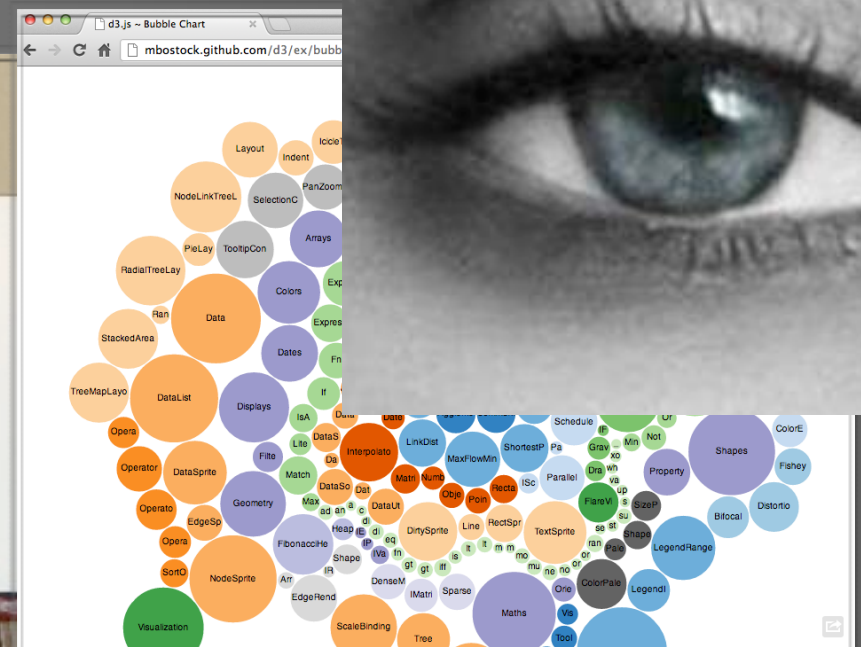
CONTEXT



ORA
Applicati



SVG





ANIMATION

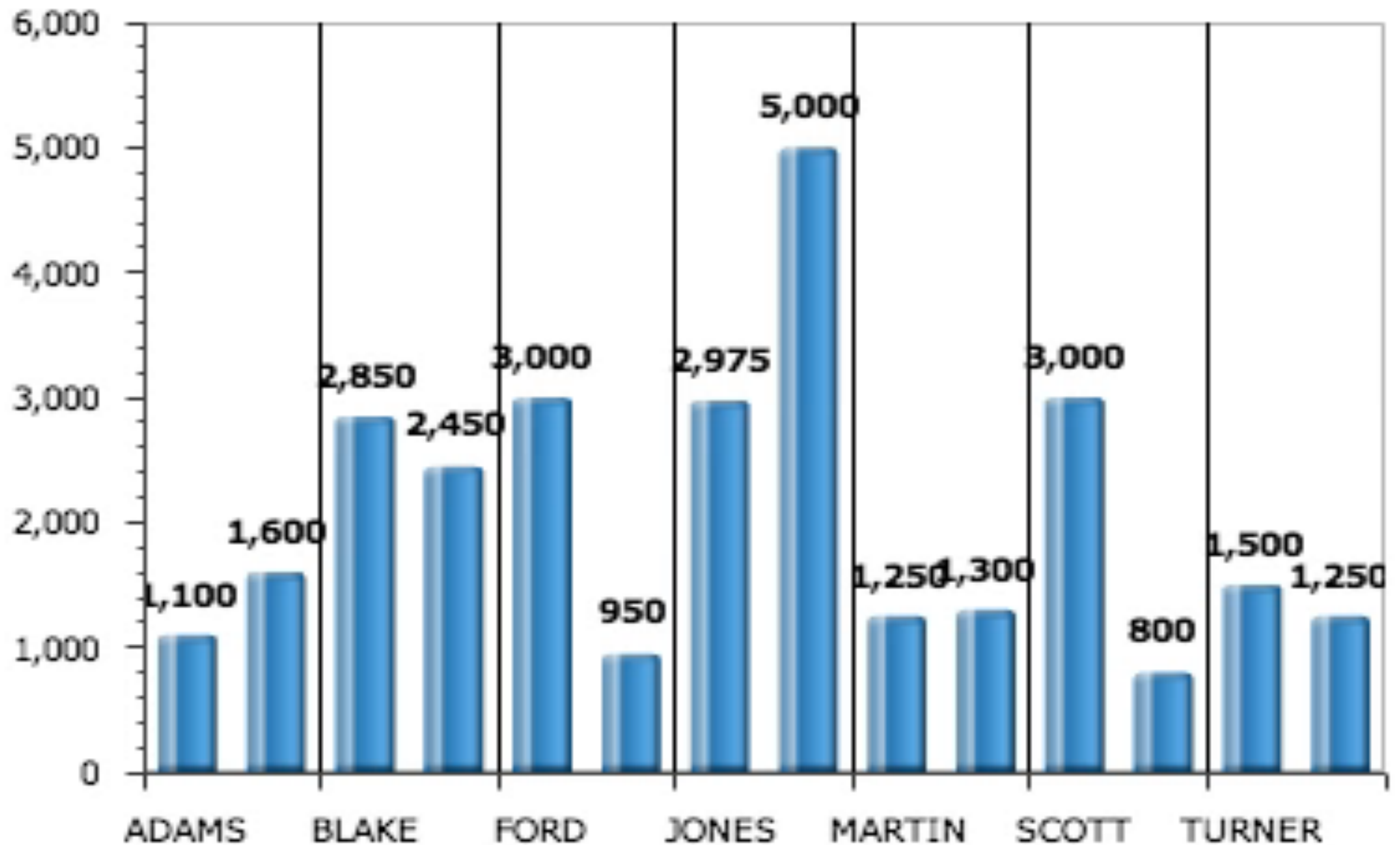
WHAT IS IT?

- **Illusion of movement**
- **Display a series of individual states**
- **Create a dynamic scene**

WHAT CAN YOU DO WITH IT?

- Expose data in a useful way
- Tell story
- With interactivity - explore data

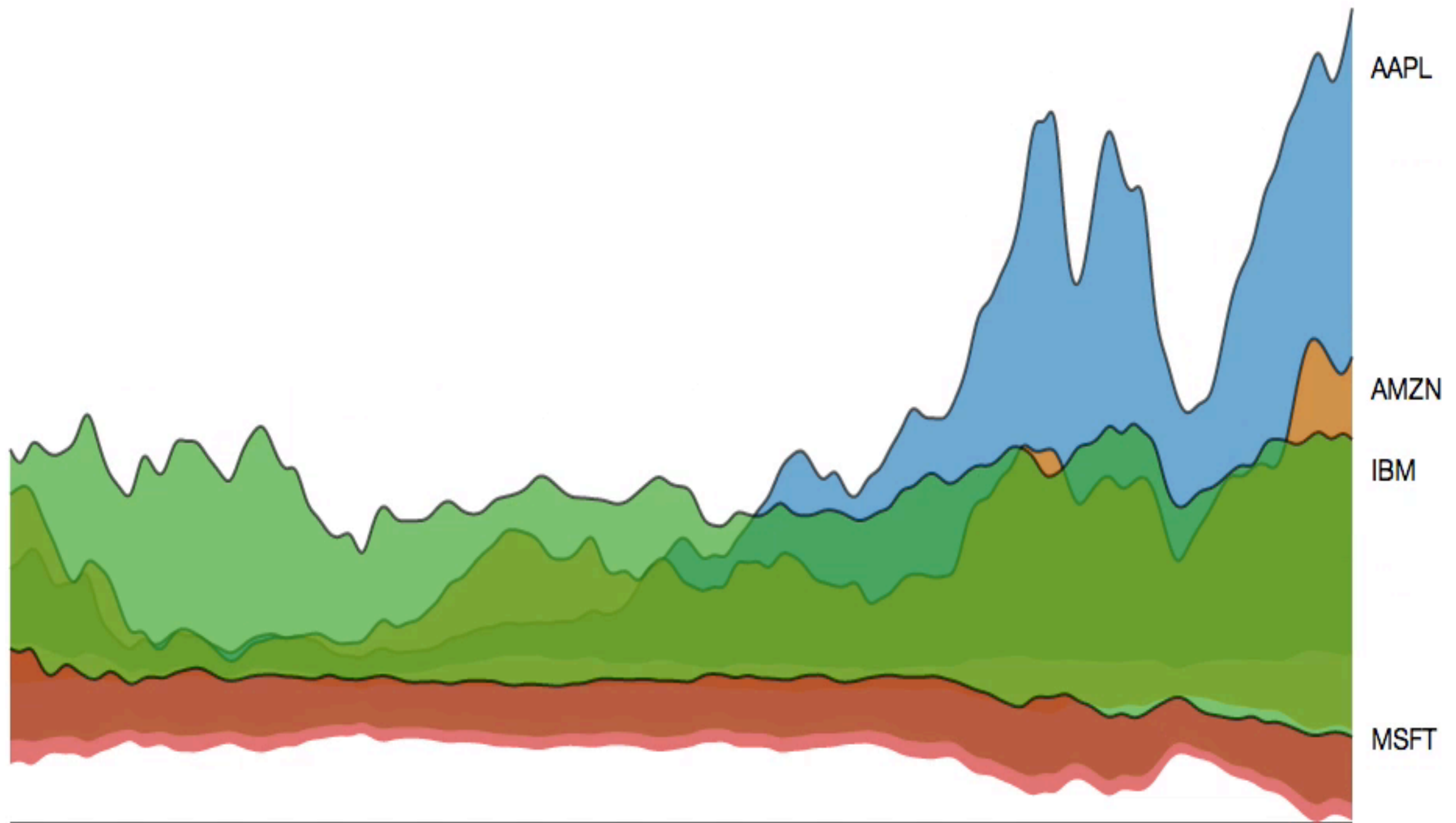
EXPOSITION



EXPOSITION

- **“Fancy” drawing of a static graphic**
- **Still communicates the same information**
- **After the first time it gets annoying**
- **Don’t we have an obligation to not do annoying things?**
- **Illusion of complexity**

EXPOSITION - USEFUL





TIME

TIME

- Time series - traditional representation of time
- Incorporate temporal elements into your graphs
 - Animation to show time relationship
 - Interactivity to explore time relationship

EXAMPLE : EXPOSITION

US energy use since independence

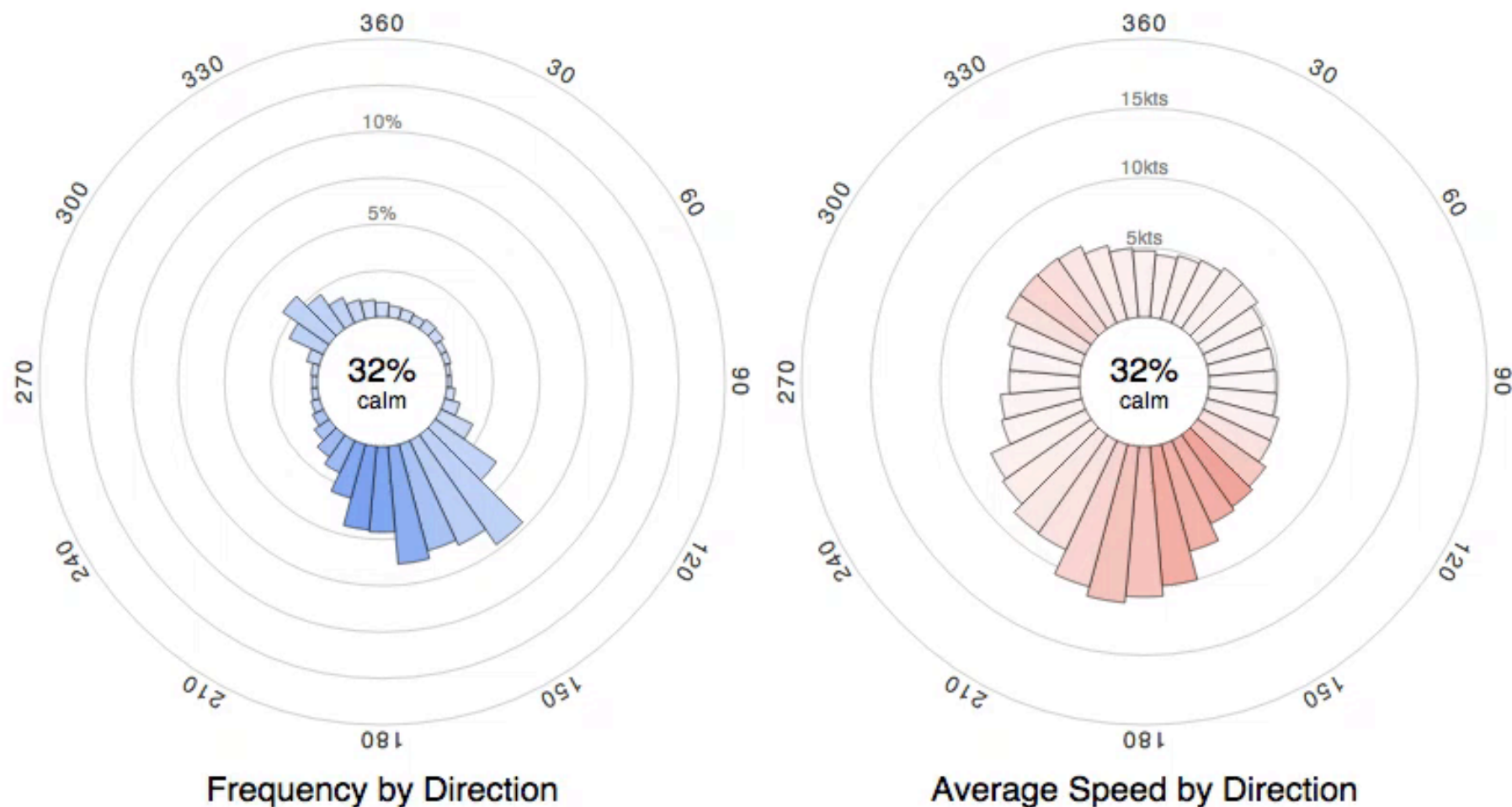
Nov 18th 2012



<http://theoldbeggar.com/visuals/us-energy-use/>

COMPLEX DATA SETS

KBFI: Seattle Boeing Field



<http://windhistory.com/station.html?KBFI>

EXAMPLE : WEB TRAFFIC

15:19:47 public_access/charts/show



<http://bl.ocks.org/WardCunningham/5861122>

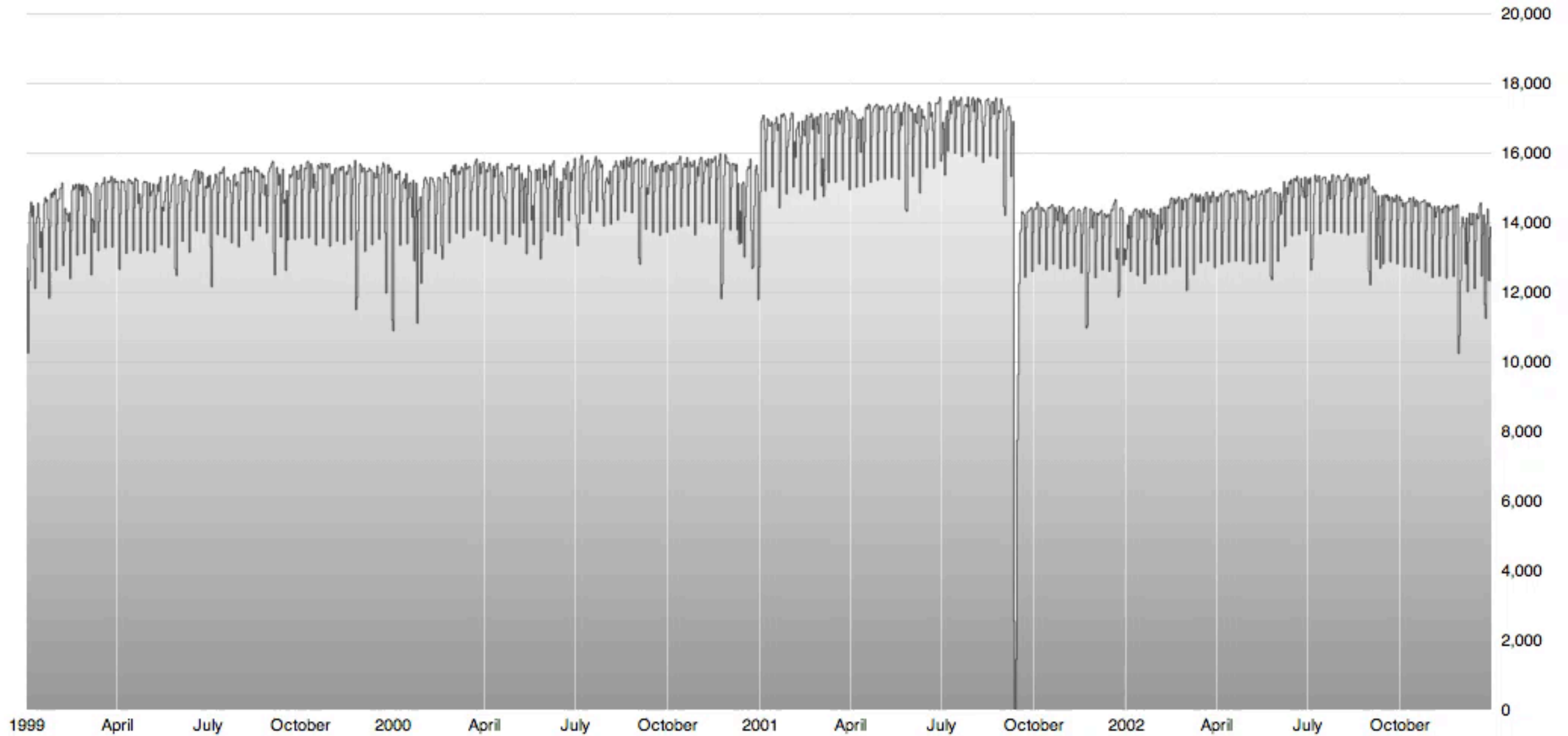


INTERACTIVITY

INTERACTIVITY

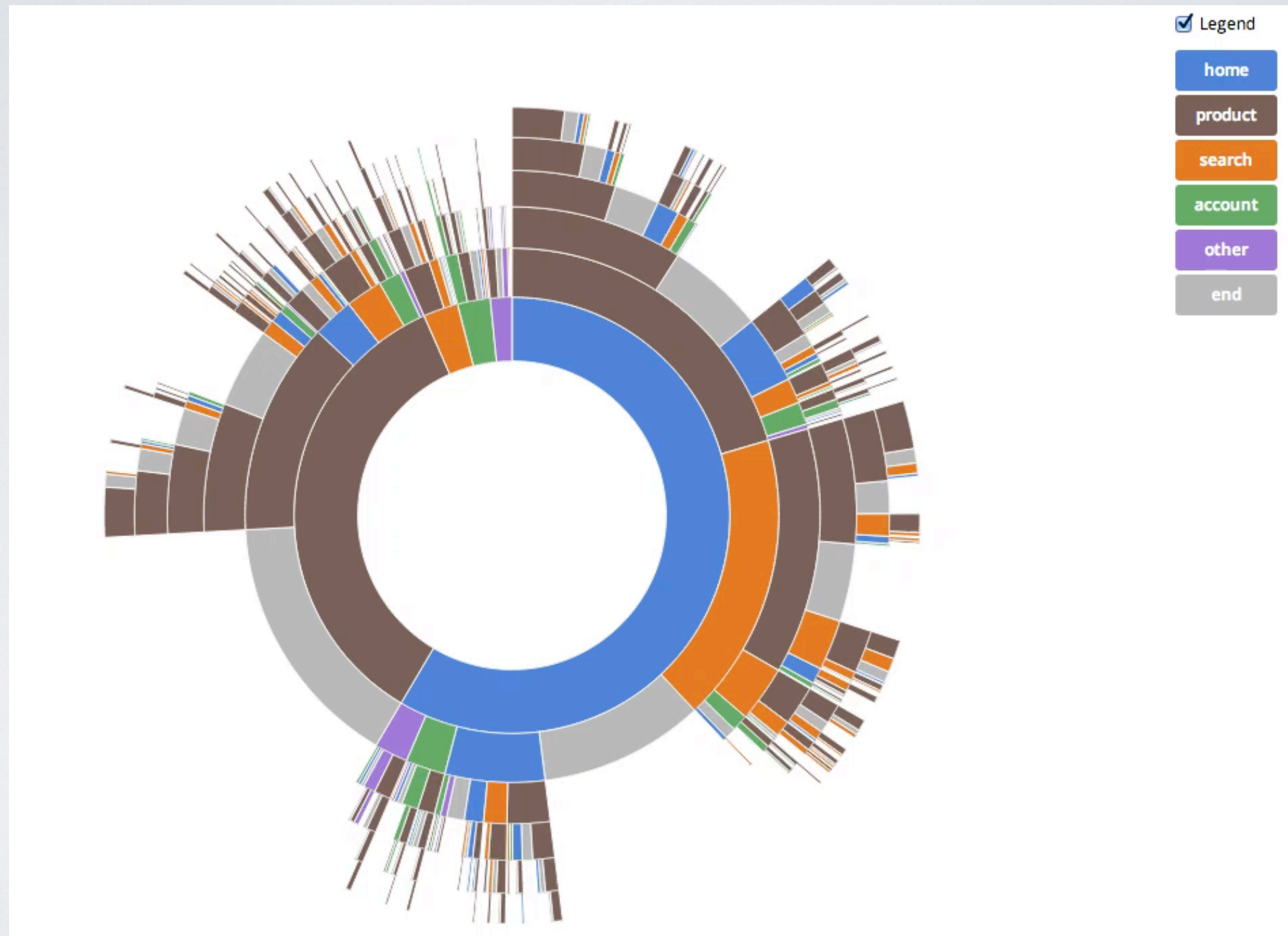
- **Two-way transfer of information**

EXPLORATION



<http://blocks.org/mbostock/4015254>

STARBURST PAGE VISITS

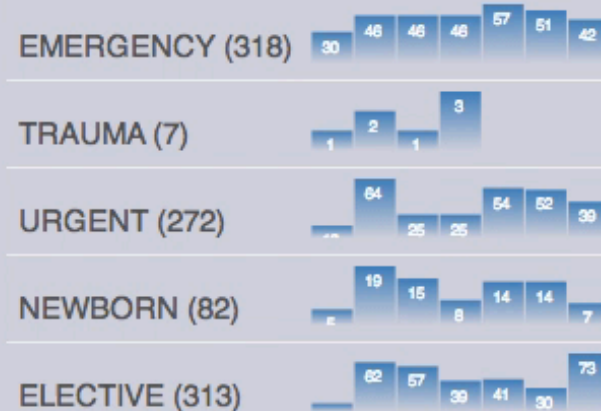


<http://blocks.org/kerryrodden/7090426>

DASHBOARD

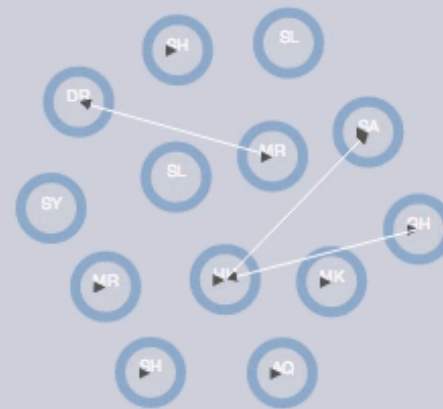
7 Day ED Admit Priority

Updated 6/23/2014 at 12:51:35 PM



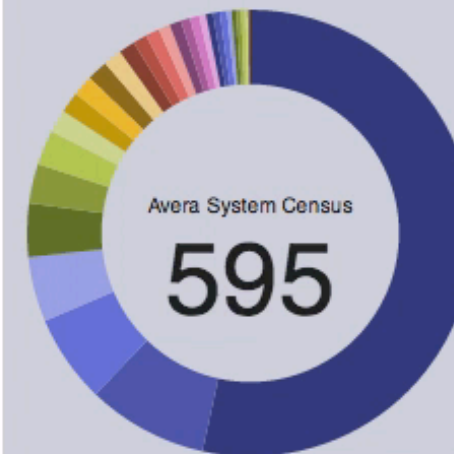
Admissions via the Emergency Department vary by acuity. Acuity categories are summarized by day.

7 Day Readmissions



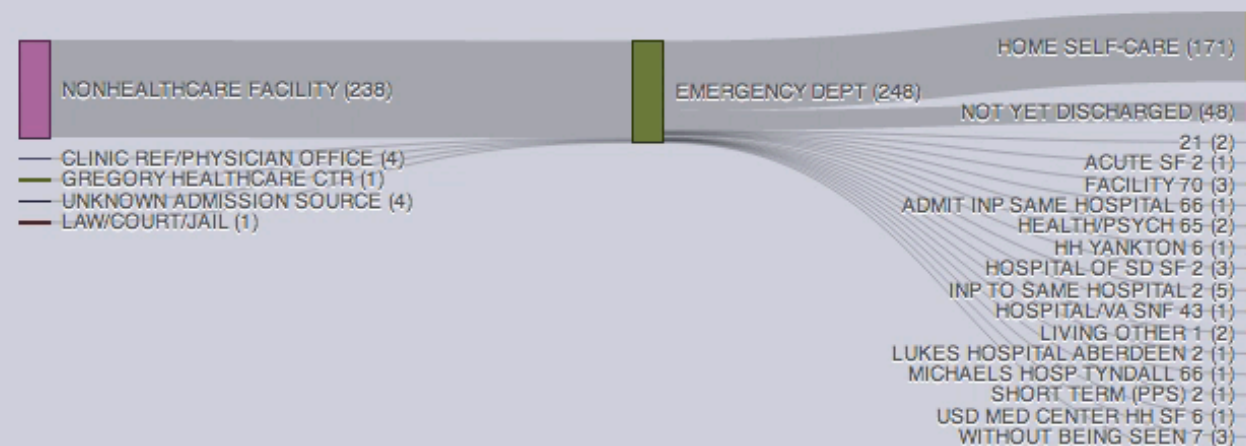
Each node represents a hospital experiencing an unplanned readmission. Arrows indicate the flow from discharging index Hospital to readmitting hospital.

Inpatient Census



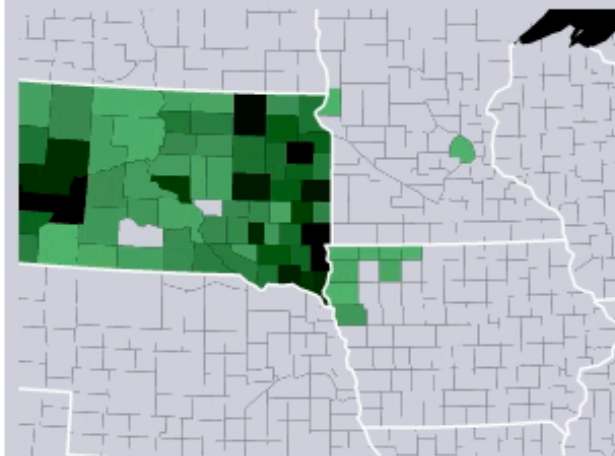
The hospital system census includes inpatient, acute rehab and swing bed. It excludes hospitals with zero census, nursery, newborns, ED, and recurring outpatient.

48hr Patient Flow from all Emergency Depts.



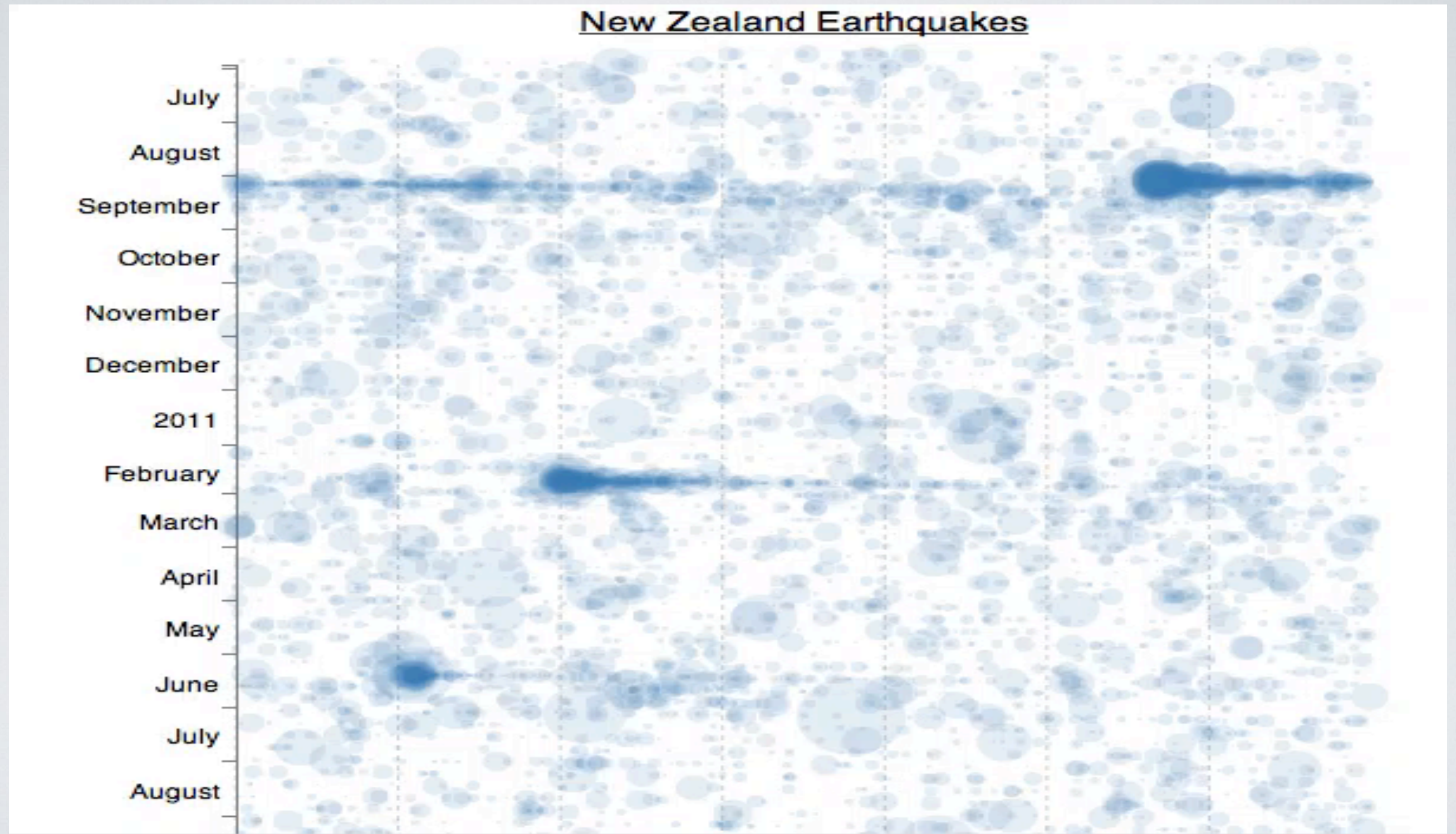
The flow of patients admitted via the Emergency Departments.

Regional Discharges



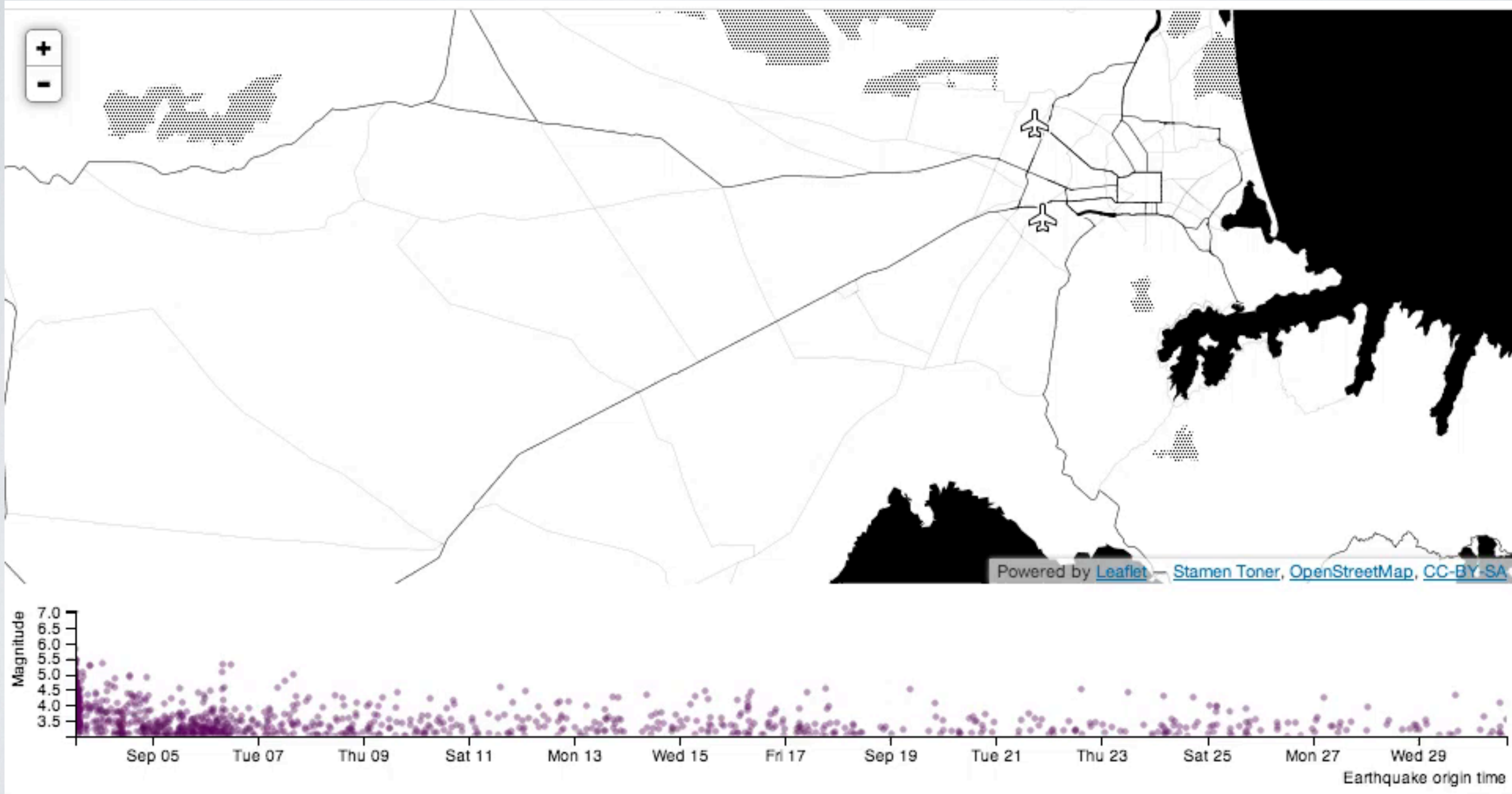
Heat maps (choropleths) can be generated from databases or websockets.

NZ EARTHQUAKES I



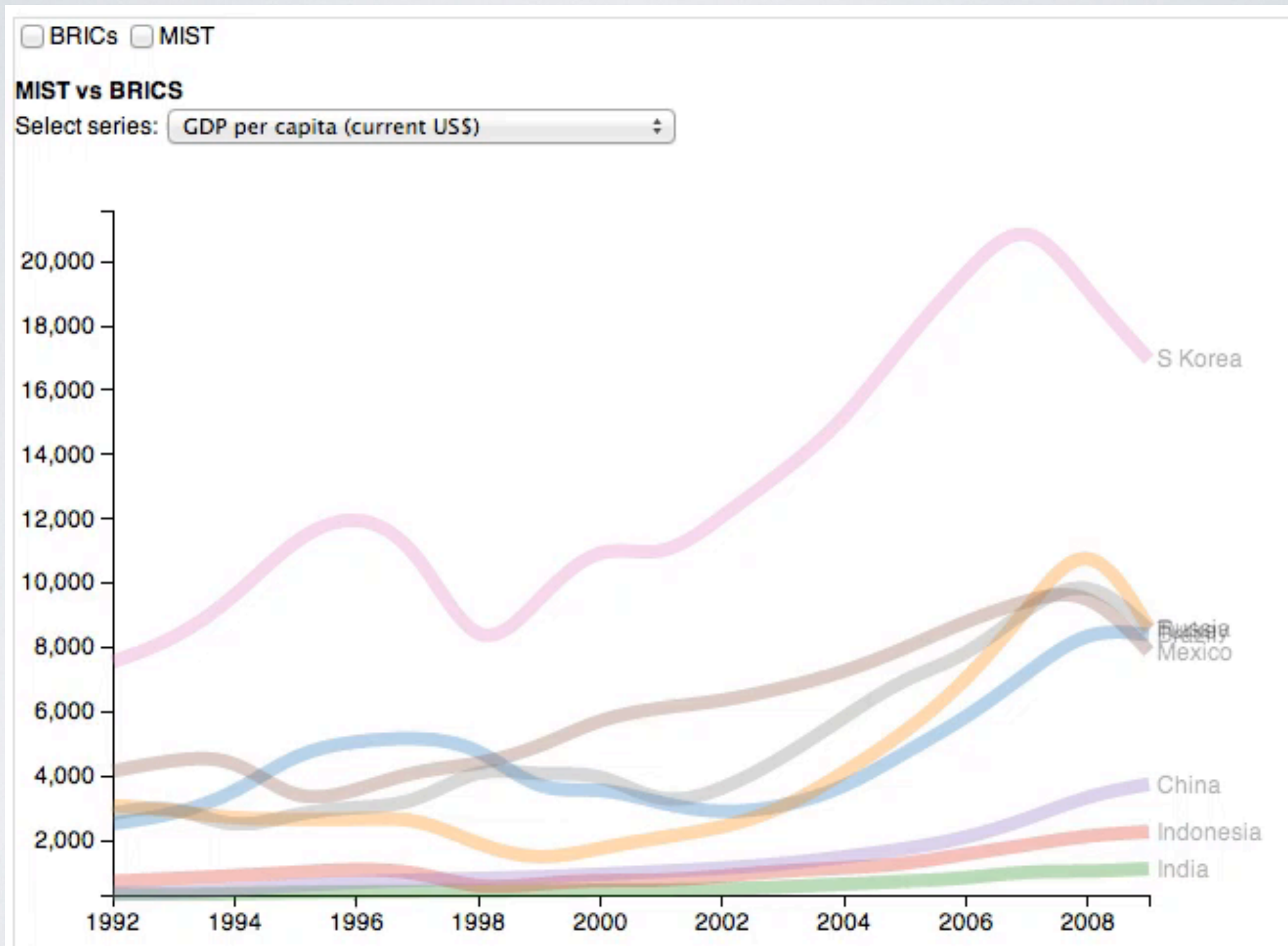
<http://bl.ocks.org/d3noob/4425979>

NZ EARTHQUAKES II



<http://bl.ocks.org/tnightingale/4718717>

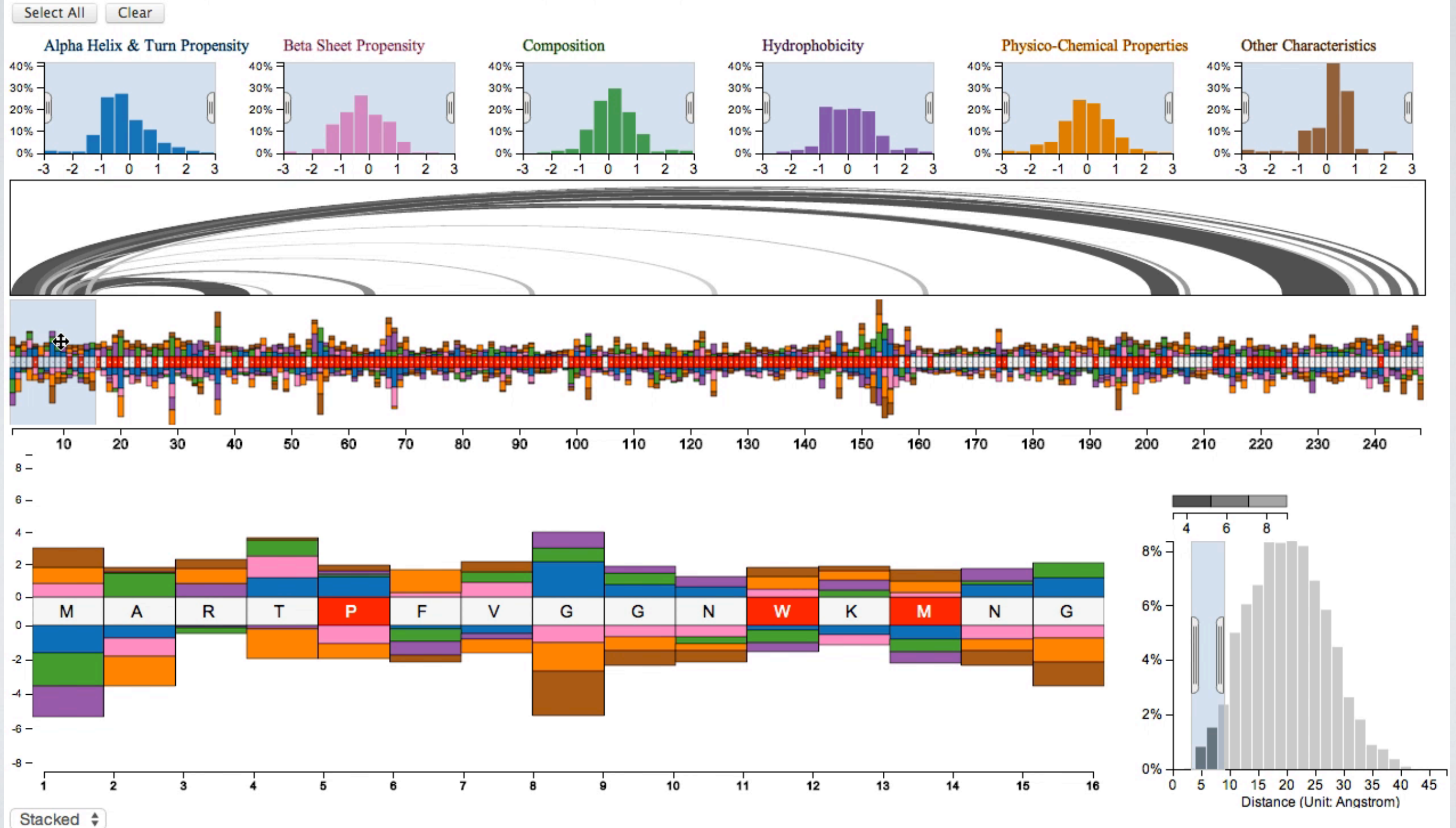
EXPLORATION - BRIC



<http://blocks.org/nsonnad/4175202>

FILTERING

BioVis Project: Identification of Mutations that Affect Protein Function



https://googledrive.com/host/0B7GI9OfZ_yIbDUxa0JqLVMyRzg/



DESIGN

DESIGN

- **Data to Ink Ratio**
- **Sketch or Prototype**
- **Plan the behavior**
- **Less can be more - don't get caught up in complexity**

BEHAVIOR MODELING

- Timeline
- Finite State Model
 - Events that the visualization responds to
 - Wait states between events
 - Transitions between states in response to events
 - Actions taken during transitions
 - Variables that hold values needed by actions between events

CODE DESIGN

- **MODEL**
- **VIEW**
- **CONTROLLER**

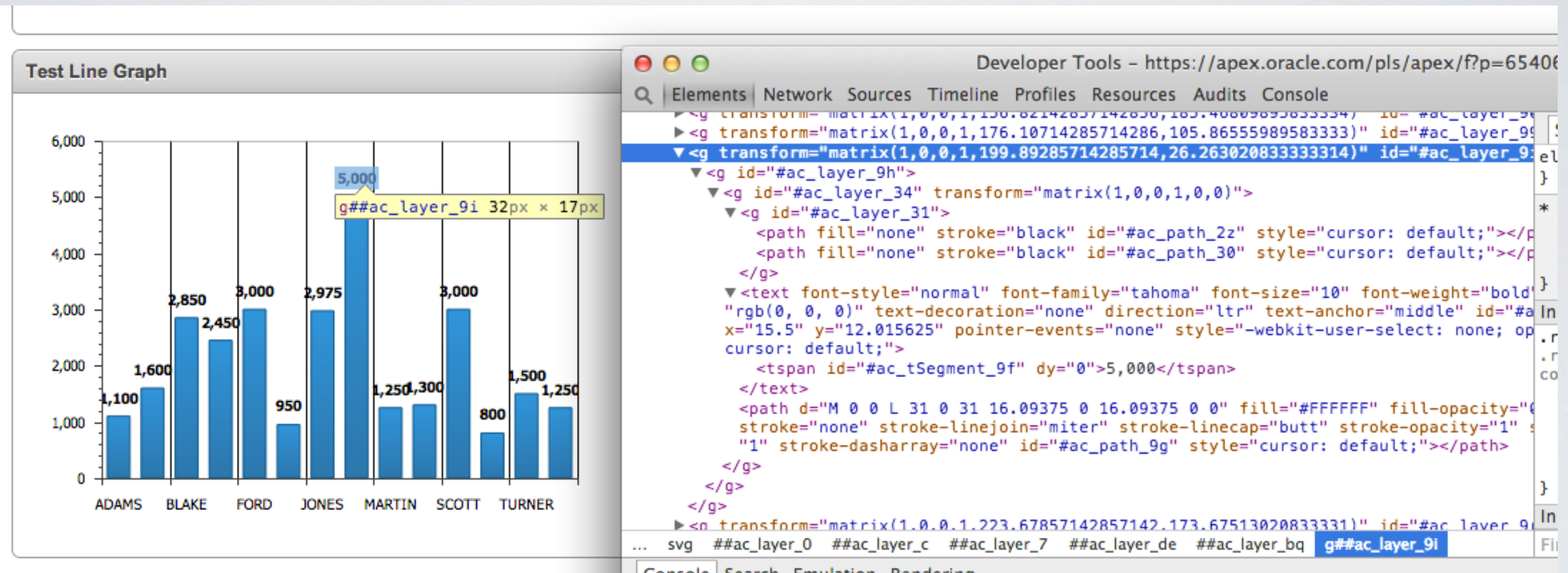


IMPLEMENTATION

TO BUILD OR NOT TO BUILD

- **Can you customize output of other tools?**
- **It depends**
 - **Can you get your bearings?**
 - **Is the code selfish?**
 - **Security - cross site scripting**

TO BUILD OR NOT TO BUILD



TOOLS - OPTIONS

- Commercial Off The Shelf
 - Flash
 - Java Applets
 - Vendor Offerings (Tableau, SAS, Spotfire)
 - Canned Graphs (AnyChart)
- Leverage Web Standards
 - JavaScript + CSS + HTML5
 - Open Source

TOOLS - CONSIDERATIONS

- **Cost**
- **Development Time**
- **Development Environments**
- **Development Talent**

OPEN SOURCE GOODIES

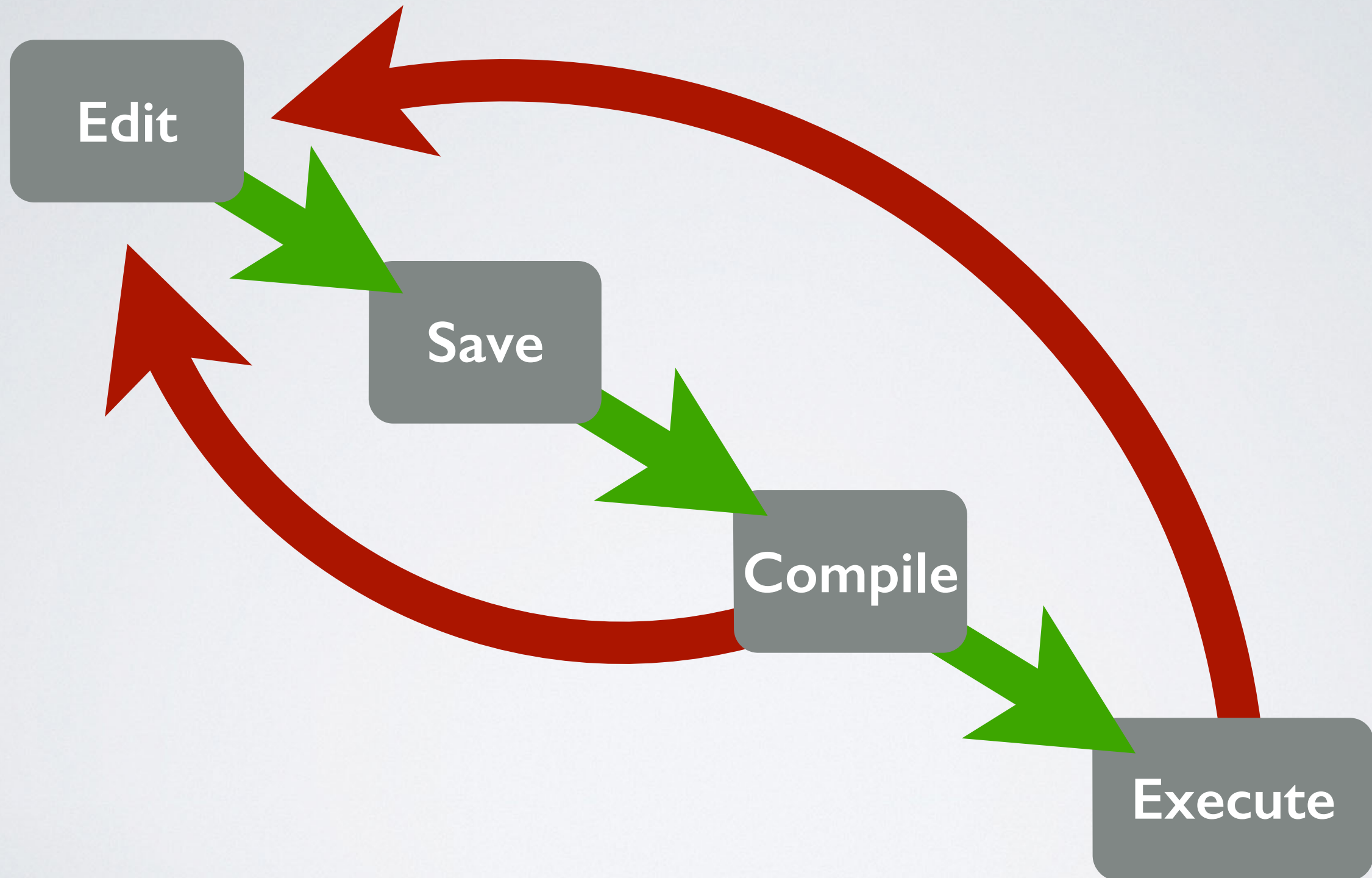
Graphics Libraries	d3.js + helpers three.js JS Infoviz Toolkit jQuery Visualize
Time Scale Libraries	moment.js jodatime.js
State Model	backbone.js
Mapping	Leaflet, Polymaps

DEVELOPMENT

- Iterate - Peel the onion
- Don't be afraid to fail
- You are the glue
- Learn web standards
- Learn about available tools
- Get familiar with APIs
- Just do it!



PROTO TO PAGE - APEX



BLOW YOUR MIND

Tributary ?

Node Upon Arcs

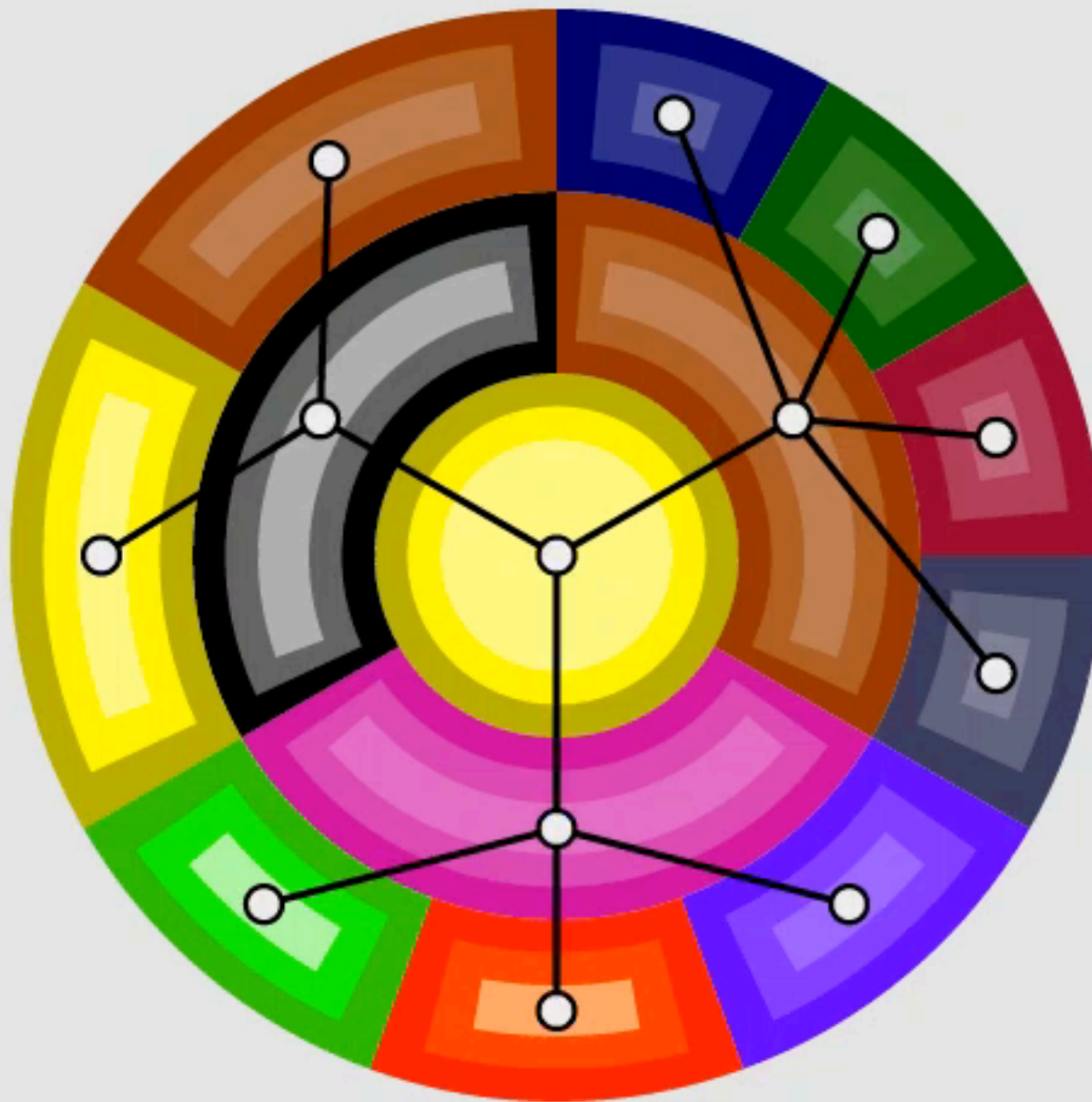
by  dmann99

Save

Fork



Log out



```
inlet.js x mydata.json x style.css x +
30 // -- Constants --
31 // -----
32
33 // Container
34 var width=800;
35 var height=800
36 // Center of graphic
37 var xCenter = width/2;
38 var yCenter = height/2;
39
40 var SpacerPx = 18; // Space between nested arcs in pixels
41 var SpacerAng = 5; // Angle separator between nested arcs in degrees
42 var LevelWidth = 100; // Width of each donut level in pixels
43 var pi = Math.PI; // Constant for a yummy dessert
44 var lineWidth = 4; // Line thickness for node graph elements
45
46
47
48 // Color related code
49
50 // Some Triplets of pleasing colors
51 // Outside / Middle / Inside
52 var colorData = [
53   {"arccolor2": "#888800", "arccolor1": "#FFFF00", "arccolor0": "#FFFF99"},
54   {"arccolor2": "#993300", "arccolor1": "#AD5C33", "arccolor0": "#80705C"},
55   {"arccolor2": "#000066", "arccolor1": "#333385", "arccolor0": "#5C5C9D"},
56   {"arccolor2": "#006600", "arccolor1": "#338533", "arccolor0": "#5C905C"},
57   {"arccolor2": "#990033", "arccolor1": "#AC3059", "arccolor0": "#8D597A"},
58   {"arccolor2": "#3D305C", "arccolor1": "#64647D", "arccolor0": "#838397"},
59   {"arccolor2": "#CC0099", "arccolor1": "#D633AD", "arccolor0": "#DE5CB0"},
60   {"arccolor2": "#6600FF", "arccolor1": "#8533FF", "arccolor0": "#905CFF"},
61   {"arccolor2": "#FF0000", "arccolor1": "#FF3300", "arccolor0": "#FFA375"},
62   {"arccolor2": "#33CC33", "arccolor1": "#00FF00", "arccolor0": "#B2FFB2"},
63   {"arccolor2": "#000000", "arccolor1": "#666666", "arccolor0": "#828282"}
64 ];
65
66 var colorCounter = 0;
67 // Set color of object, rotate through predefined palette
68 function setColors(myObj) {
69   myObj.fillcolor2 = colorData[colorCounter%colorData.length].arccolor2;
70   myObj.fillcolor1 = colorData[colorCounter%colorData.length].arccolor1;
71   myObj.fillcolor0 = colorData[colorCounter%colorData.length].arccolor0;
72   colorCounter++;
73 }
74
75
76
77 // Output to renderer
78 var data = new Array();
79
80 // Using current level and existence of parents
81 // calculate parent arc info
82 function setArcInfo(myObj) {
83   // We are at the root label leaf at targetDepth, analyze it
84   if (myObj.level === 0) {
```

GIF

Config

Add libraries

Fullscreen

<http://tributary.io>



GRAPH BUILDING

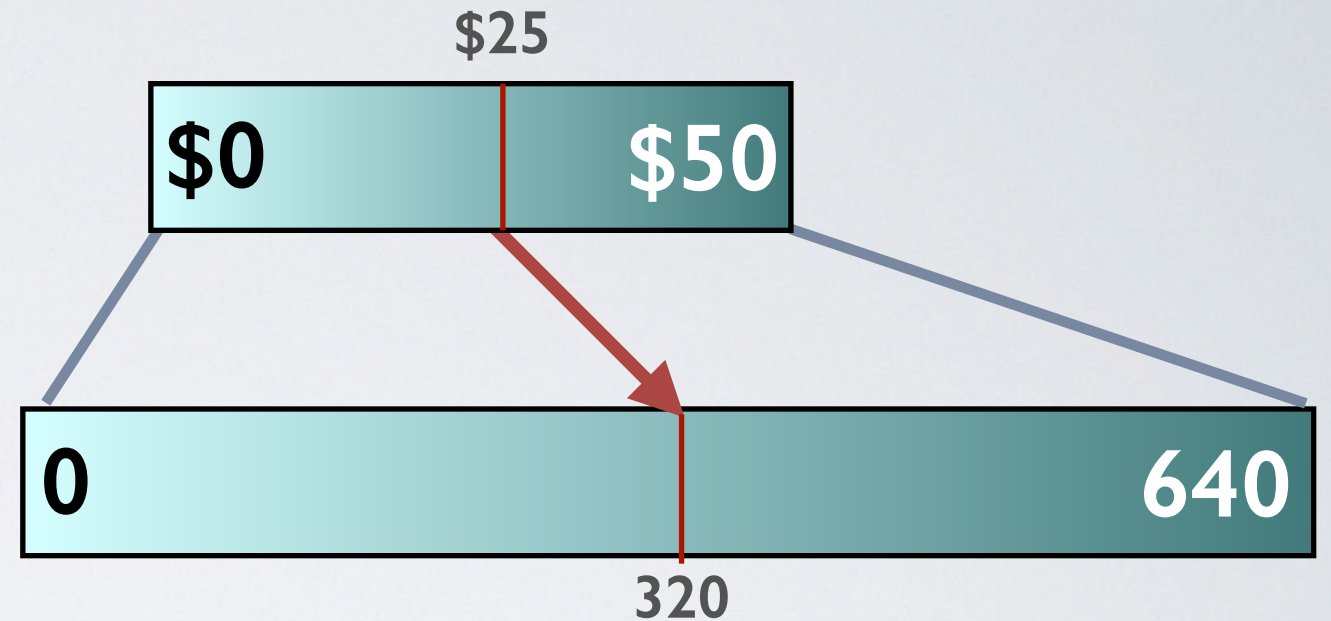
2D SHAPE PRIMITIVES

- Rectangles
- Circles & Arcs
- Lines
- Poly shapes & Curves
- Grouping

SCALES

- Input domain

- Output range



- Not just for positioning/sizing

- Rotating use of colors

- Time translations

TRANSITIONS

- Delay / Duration
- Style
- Position
- Easing

BEHAVIORS

- **OnClick()**
- **OnMouseOver()**
- **OnMouseOut()**
- **Timers**
- **Tick()**

D3 / SVG BASICS

- Library not a Framework
- Leverages SVG
- Bind data to elements
- Once bound you can visit selections and perform operations on them
 - Style Transitions
 - Size Transitions
 - Position Transitions



DEMOS

D3 + APEX

- Add D3 library to static file repository
 - Reference D3 library in Page Header
- Define Restful service to supply data in JSON format
- Develop JS script to generate your graphic
- Add any custom CSS to page

GIVE IT A REST

Resource Handler

A resource handler is a query or an anonymous PL/SQL block responsible for handling a particular HTTP method template, only one resource handler per HTTP method is permitted.

RESTful Service Module:

URI Template: allempdata

Method GET

Source Type Query Format JSON

Requires Secure Access No

Pagination Size

Source

* Source

```
SELECT * FROM EMP ORDER BY SAL DESC
```

GIVE IT A TEST

```
{
  "next": {
    "$ref": "https://apex.oracle.com/pls/apex/dmann/allempdata?page=1"
  },
  "items": [
    {
      "empno": 7839,
      "ename": "KING",
      "job": "MANAGER",
      "mgr": null,
      "hiredate": "1981-05-17T00:00:00Z",
      "sal": 5000,
      "deptno": 10
    },
    {
      "empno": 7698,
      "ename": "BLAKE",
      "job": "MANAGER",
      "mgr": 7839,
      "hiredate": "1981-05-01T00:00:00Z",
      "sal": 2850,
      "deptno": 10
    },
    {
      "empno": 7782,
      "ename": "CLARK",
      "job": "MANAGER",
      "mgr": 7839,
      "hiredate": "1981-06-09T00:00:00Z",
      "sal": 2450,
      "deptno": 10
    },
    {
      "empno": 7566,
      "ename": "JONES",
      "job": "MANAGER",
      "mgr": 7839,
      "hiredate": "1981-04-02T00:00:00Z",
      "sal": 2975,
      "deptno": 20
    },
    {
      "empno": 7788,
      "ename": "SCOTT",
      "job": "ANALYST",
      "mgr": 7566,
      "hiredate": "1982-12-09T00:00:00Z",
      "sal": 3000,
      "deptno": 20
    },
    {
      "empno": 7902,
      "ename": "FORD",
      "job": "ANALYST",
      "mgr": 7566,
      "hiredate": "1981-12-03T00:00:00Z",
      "sal": 3000,
      "deptno": 20
    },
    {
      "empno": 7369,
      "ename": "SMITH",
      "job": "CLERK",
      "mgr": 7902,
      "hiredate": "1980-12-17T00:00:00Z",
      "sal": 800,
      "deptno": 20
    },
    {
      "empno": 7499,
      "ename": "ALLEN",
      "job": "SALESMAN",
      "mgr": 7698,
      "hiredate": "1981-02-20T00:00:00Z",
      "sal": 1600,
      "comm": 300,
      "deptno": 30
    },
    {
      "empno": 7521,
      "ename": "WARD",
      "job": "SALESMAN",
      "mgr": 7698,
      "hiredate": "1981-02-22T00:00:00Z",
      "sal": 1250,
      "comm": 500,
      "deptno": 30
    },
    {
      "empno": 7654,
      "ename": "MARTIN",
      "job": "SALESMAN",
      "mgr": 7698,
      "hiredate": "1981-09-28T00:00:00Z",
      "sal": 1250,
      "comm": 1400,
      "deptno": 30
    },
    {
      "empno": 7844,
      "ename": "TURNER",
      "job": "SALESMAN",
      "mgr": 7698,
      "hiredate": "1981-09-08T00:00:00Z",
      "sal": 1500,
      "comm": 0,
      "deptno": 30
    },
    {
      "empno": 7876,
      "ename": "ADAMS",
      "job": "CLERK",
      "mgr": 7788,
      "hiredate": "1983-01-12T00:00:00Z",
      "sal": 1100,
      "deptno": 20
    },
    {
      "empno": 7900,
      "ename": "JAMES",
      "job": "CLERK",
      "mgr": 7698,
      "hiredate": "1981-12-03T00:00:00Z",
      "sal": 950,
      "deptno": 30
    },
    {
      "empno": 7934,
      "ename": "MILLER",
      "job": "CLERK",
      "mgr": 7782,
      "hiredate": "1982-01-23T00:00:00Z",
      "sal": 1300,
      "deptno": 10
    }
  ]
}
```



```
"}, "items": [{ "en
```


JAVASCRIPT SNIPPET

Region Source

```
<script type="text/javascript">

d3.json("https://apex.oracle.com/pls/apex/dmann/allempdata", function(json) {

    var mydata=json.items;

    var svg = d3.select("svg");

    d3.select(".chart")
        .selectAll("div")
        .data(mydata)
        .enter()
        .append("div")
        .style("width", function(d) { return d.sal/5 + "px"; })
        .text(function(d) { return " "+d.ename+" / "+d.sal; });

});

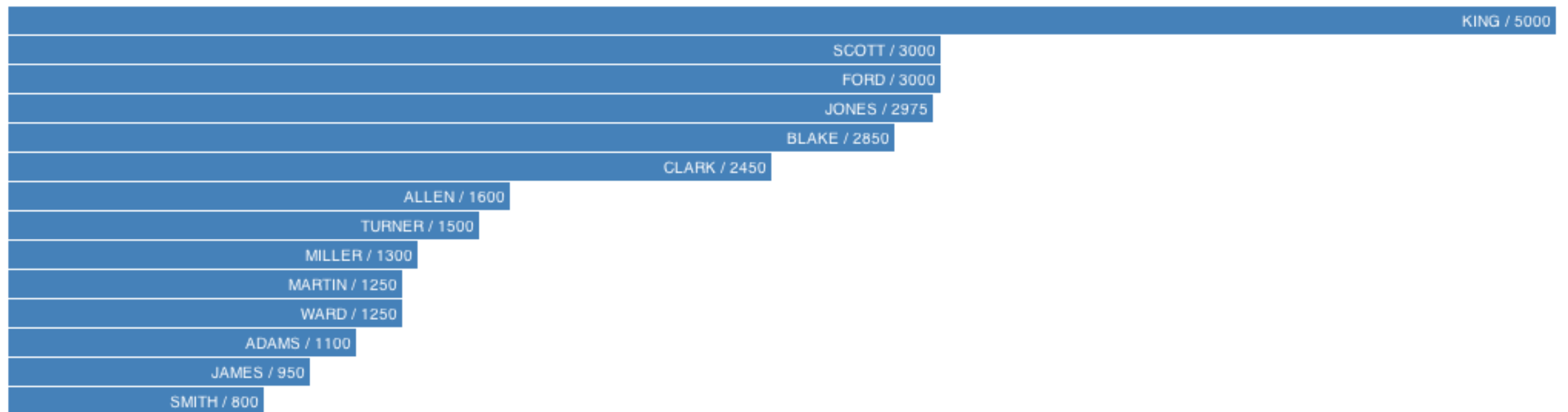
</script>
```

RESULT

JSON to D3 Test

Home

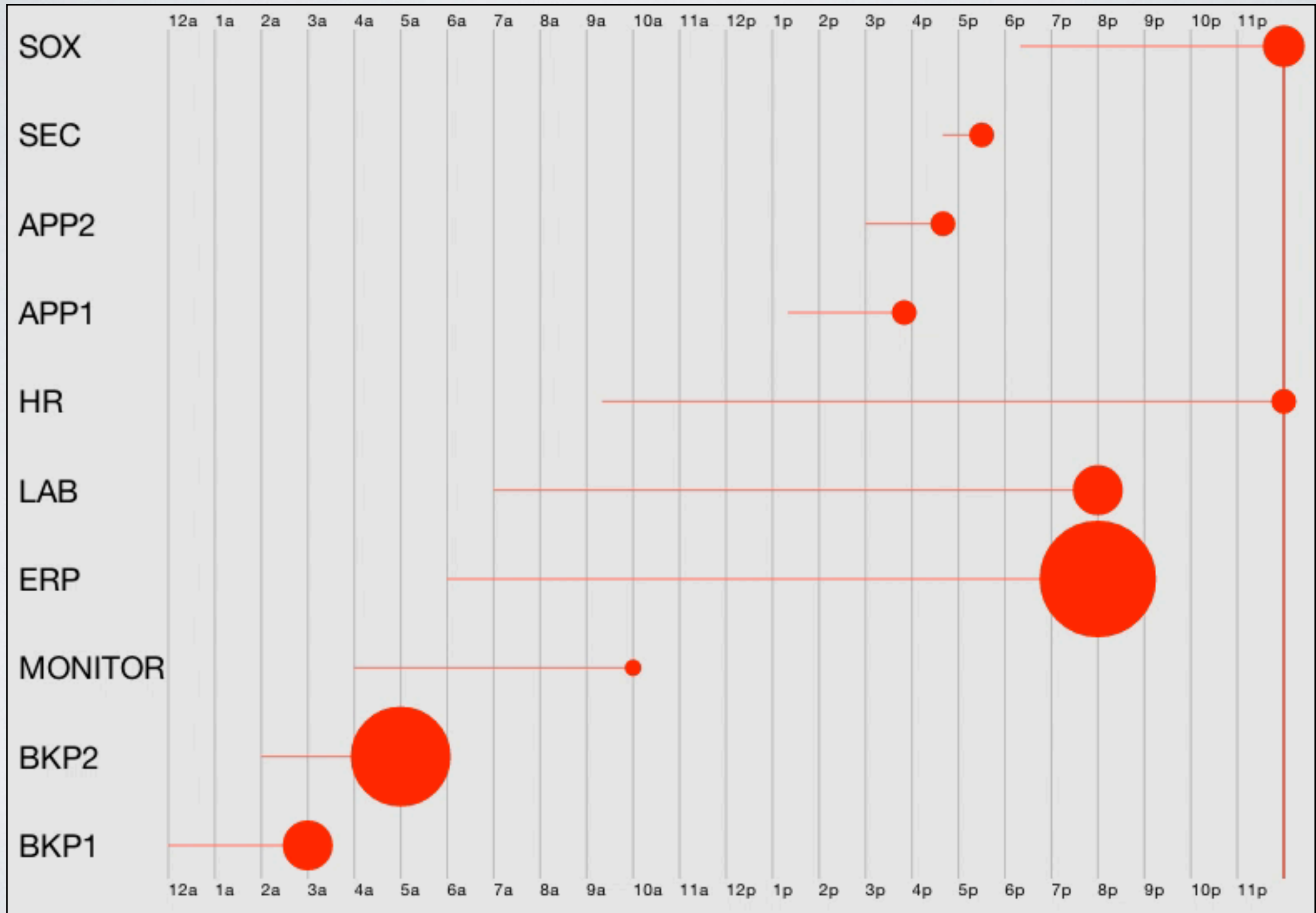
Home



DEMO : BACKUPS ACROSS THE ENTERPRISE

- **I wanted an overview of 24 hours of backups across the enterprise.**
- **I had a huge scrollable Gantt chart provided by the backup scheduling tool. I hated it.**
- **I wanted more information about volume of backups.**

BACKUPS ACROSS THE ENTERPRISE



<http://tributary.io/inlet/d3c88e18e54eb5c72bea>

DEMO : POP-UP SCHEMIO



+ history of your schema

Show the evolution of a schema



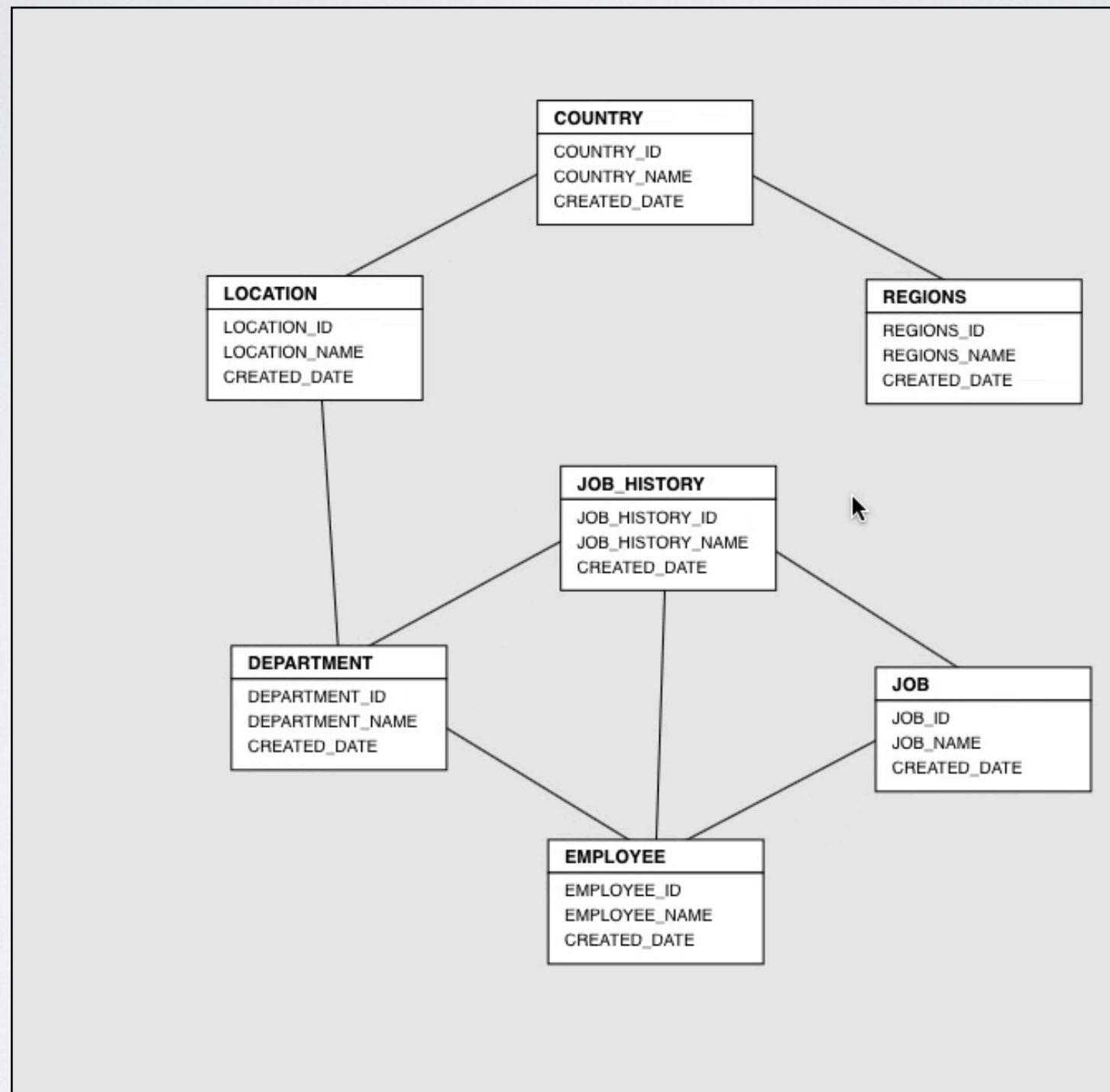
Show sequence of changes

Connections between objects



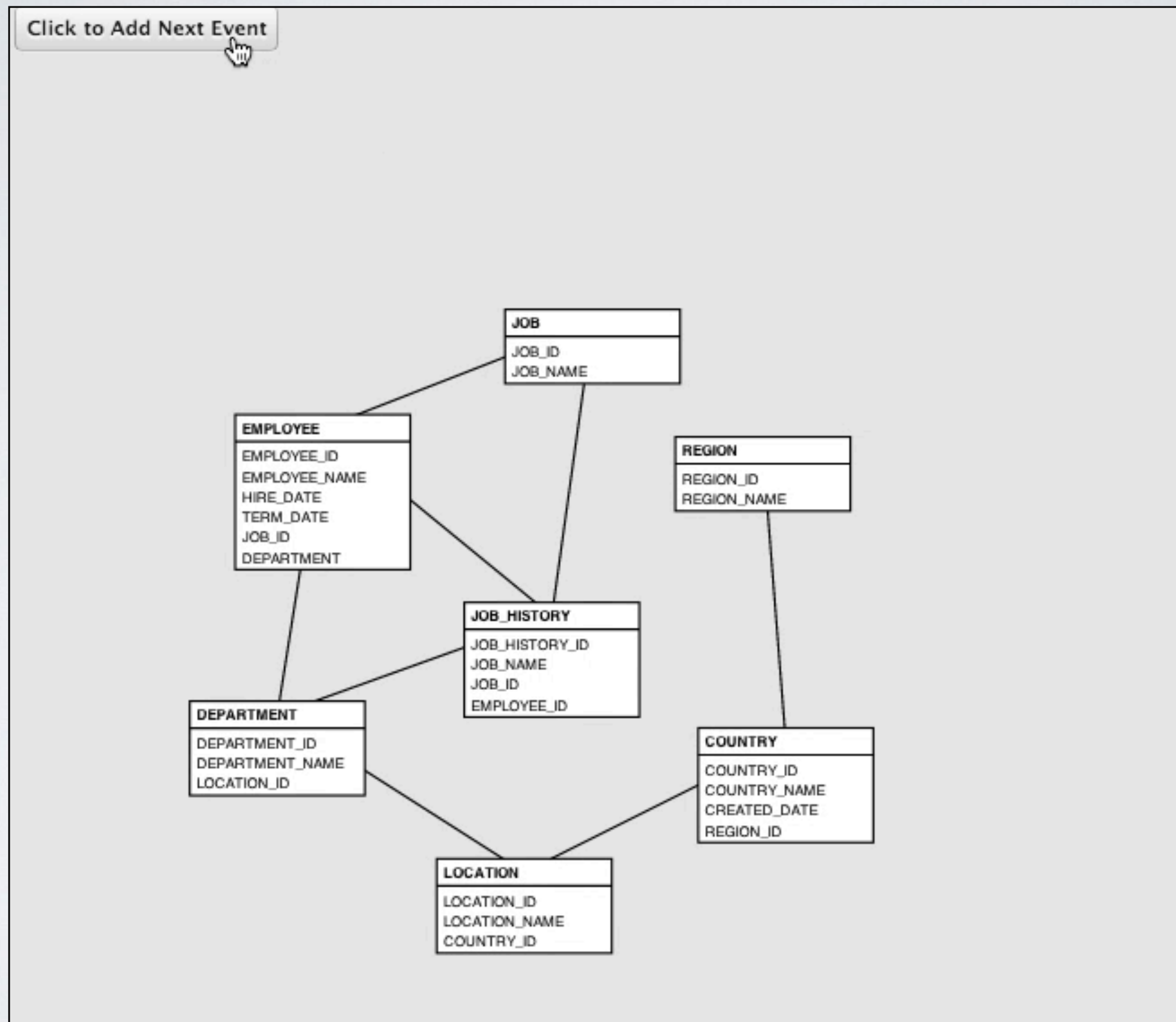
Allow basic exploration

SCHEMIO TRY I



<http://tributary.io/inlet/3e0c3ec6fd63b7413034>

SCHEMIO TRY ... 5



<http://tributary.io/inlet/419935c191e2f1845d94>

WHERE DO I GO FROM HERE?

- Give D3 a spin
 - Lots of Tutorials
 - Scott Murray Books + Website
- Leverage other's code
 - Helper Libraries - dc.js / crossfilter / etc
 - Examples - 1000 now 2000
- Reuse via libraries or Apex Plugin framework

FURTHER READING

- **Designing Data Visualizations: Intentional Communication from Data to Display** by Noah Iliinsky and Julie Steele. O'Reilly Media, 2011.
- **Data Visualization: A Successful Design Process** by Andy Kirk. Packt Publishing, 2012.
- **Interactive Data Visualization for the Web** by Scott Murray. O'Reilly Media, 2013.

QUESTIONS

Slides, code, links :
<http://ba6.us>

david@ba6.us

[@ba6dotus](#)

