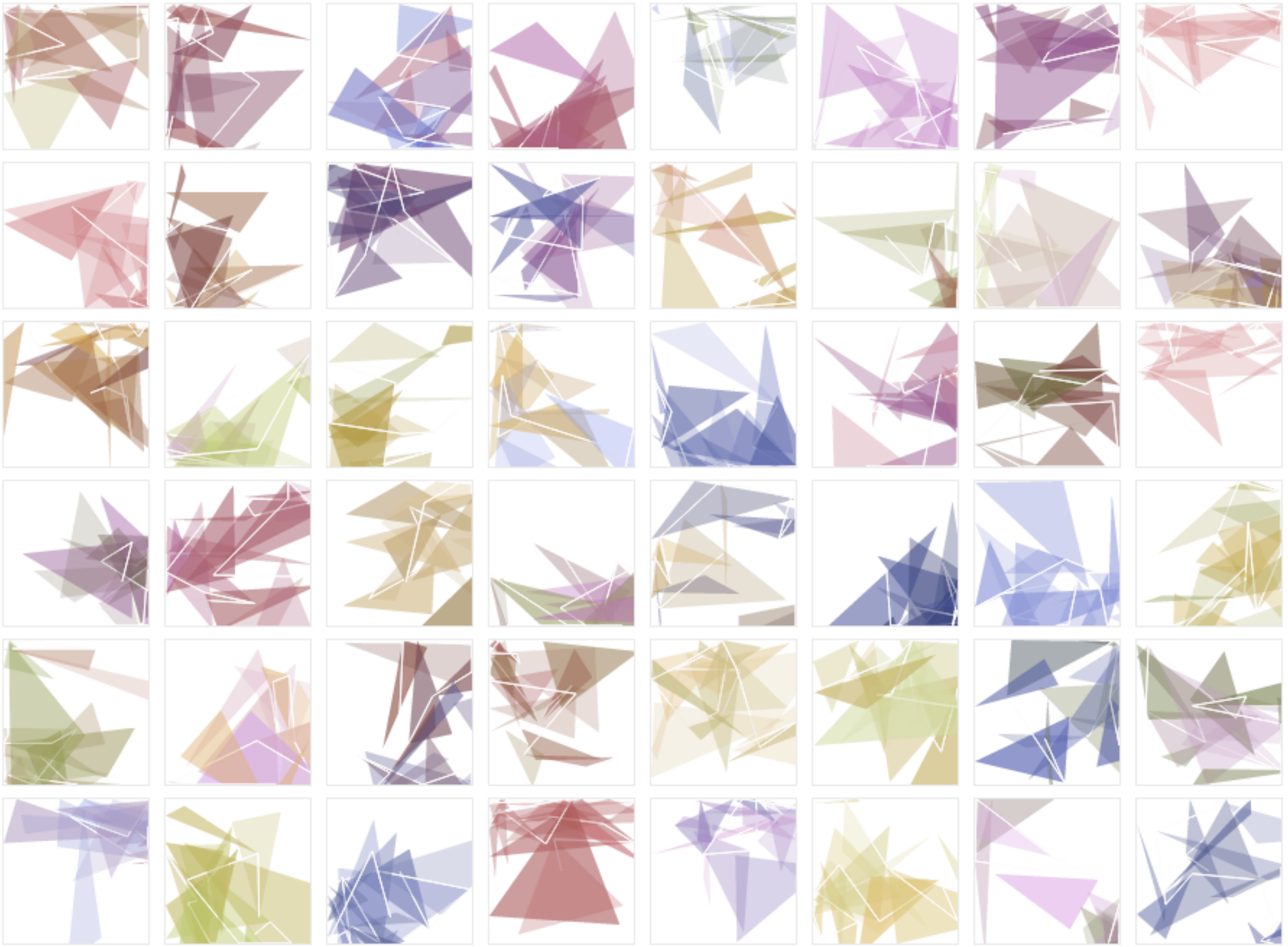
Code Architecture and D3

Irene Ros
@ireneros
http://ireneros.com | http://github.com/iros | http://github.com/misoproject

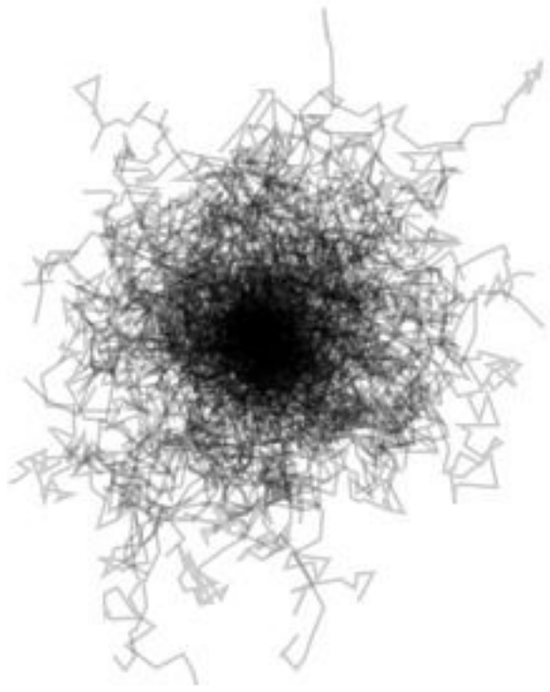
http://bocoup.com

http://misoproject.com

http://openvisconf.com

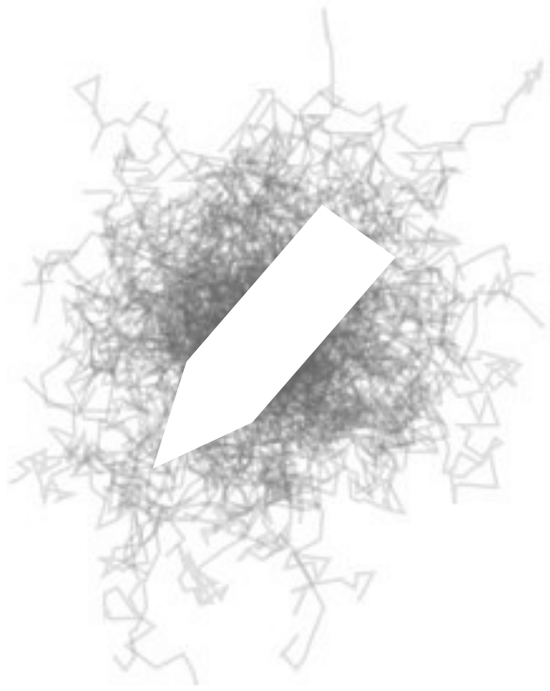


http://ireneros.com/triangles/

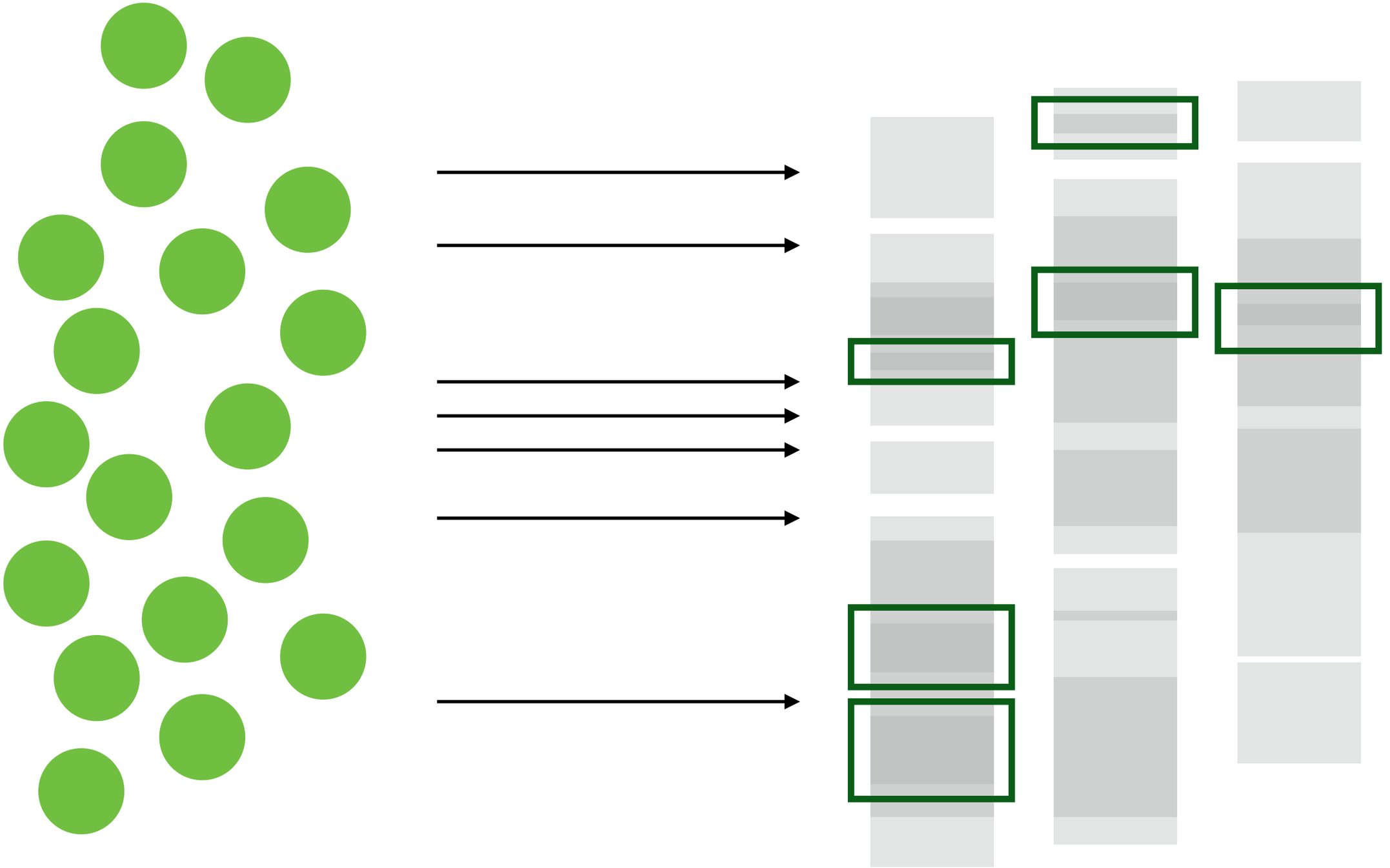


I love patterns

I love architecting code



I love to teach



My d3 "context"

Big apps

Lots of chart reuse

Mostly standard charts

Lots of data points (1000+ series on a line chart)

All the maps, all the time

Coordination between charts & other components

What I'm building

Build chart **A**

Build chart **A** again

Build chart **A** but make it look different (Style/layout)

Build chart **A** but add functionality **B**

Build chart **A** with functionality **B** and functionality **C**

For mobile use chart **A**, but not functionalities **B** or **C**

For tablet use chart **A** with functionality **B**, but no **C**

Now build chart **A2** that's like **A** but different...

What does it need to do

It has to manage a bunch of containers (g/div/etc)

It renders data (obviously)

It redraws or may need to redraw in the future

It has scales (x, y, colors etc)

It needs dimensions (height, width, margin)

It needs to know what device it's on (mobile,web,tablet)

It uses some visual marks, often many types for the same data

It needs to capture user interactions and possibly react

How we build it

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    height = 500;

var y = d3.scale.linear()
    .range([height, 0]);

var chart = d3.select(".chart")
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    .attr("height", height);

d3.tsv("data.tsv", type, function(error, data) {
  y.domain([0, d3.max(data, function(d) { return d.value; })]);

  var barWidth = width / data.length;

  var bar = chart.selectAll("g")
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    .enter().append("g")
      .attr("transform", function(d, i) { return "translate(" + i * barWidth + ",0)"; });

  bar.append("rect")
      .attr("y", function(d) { return y(d.value); })
      .attr("height", function(d) { return height - y(d.value); })
      .attr("width", barWidth - 1);

  bar.append("text")
      .attr("x", barWidth / 2)
      .attr("y", function(d) { return y(d.value) + 3; })
      .attr("dy", ".75em")
      .text(function(d) { return d.value; });
});

function type(d) {
  d.value = +d.value; // coerce to number
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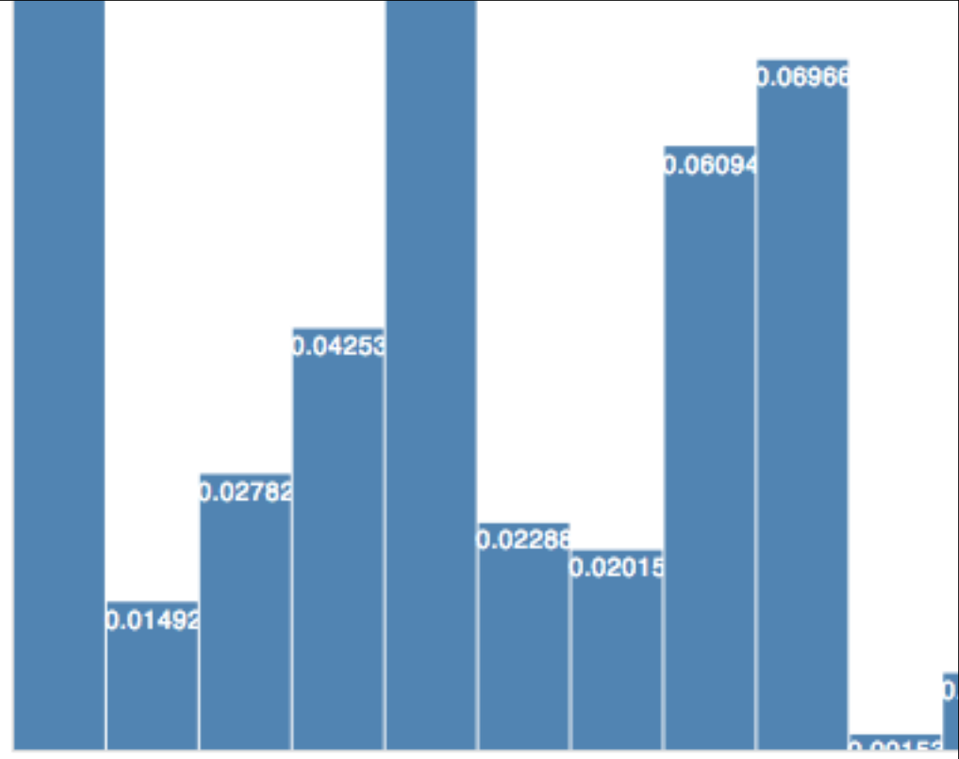

http://bl.ocks.org/mbostock/7452541

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Dimensions (height/width/margins)

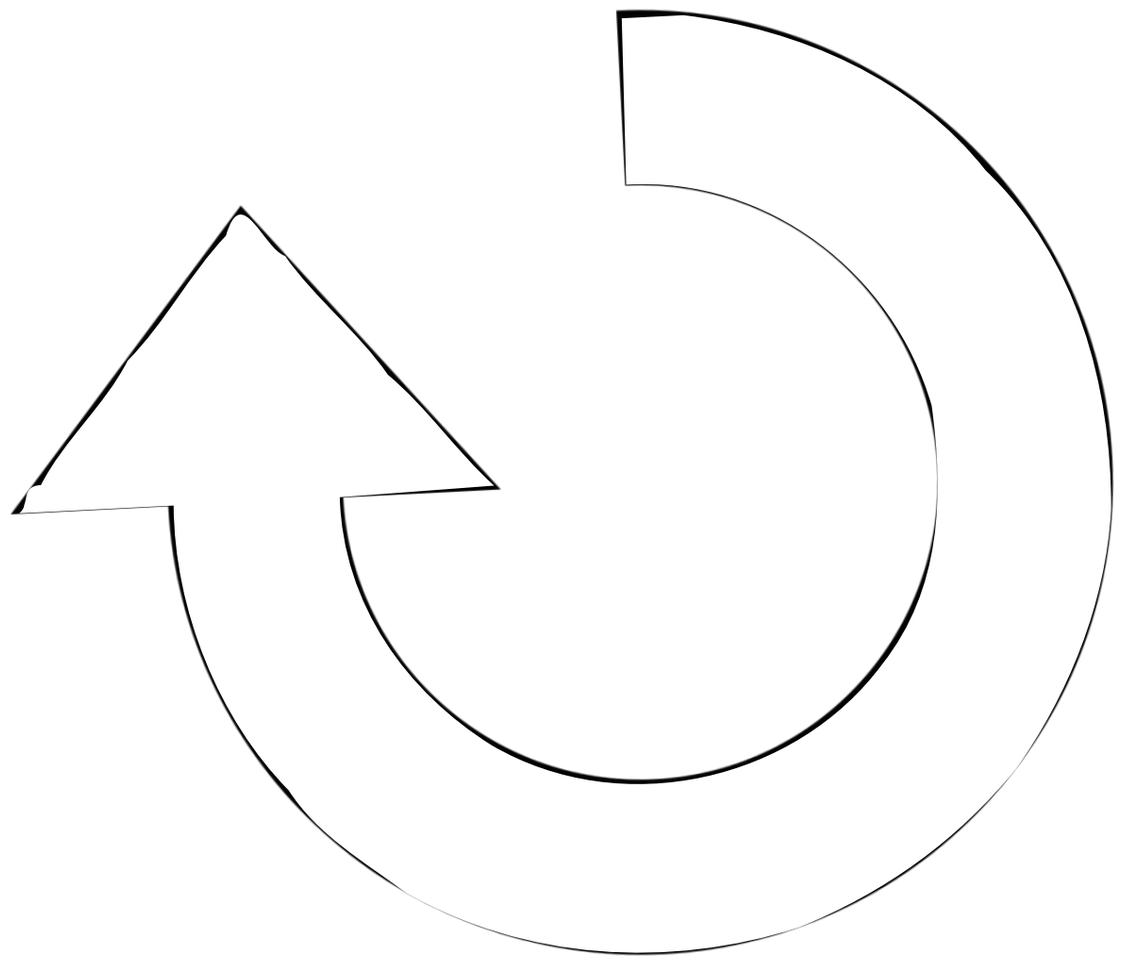
Scales (range & domain defined separately)

Some containers

Calculations that happen because data is available

A data binding

Enter/update/exit selections & respective transition selections



Repeat by Dimitry Sokolov from The Noun Project

Making **Reusable** Charts

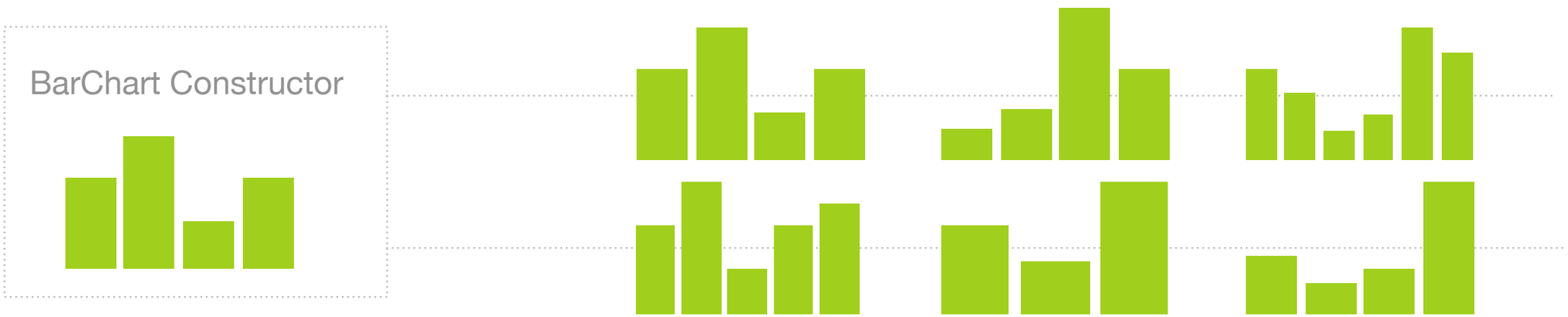
Towards Reusable Charts
http://bost.ocks.org/mike/chart/

What is a reusable chart?

Difficulty level:

Repeatable

Easy to create multiple instances of

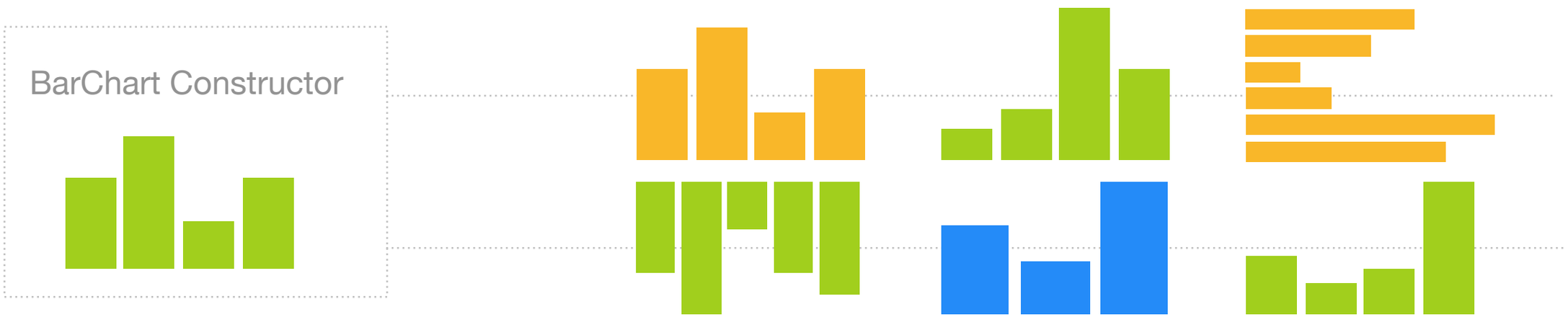


What is a reusable chart?

Difficulty level:

Configurable

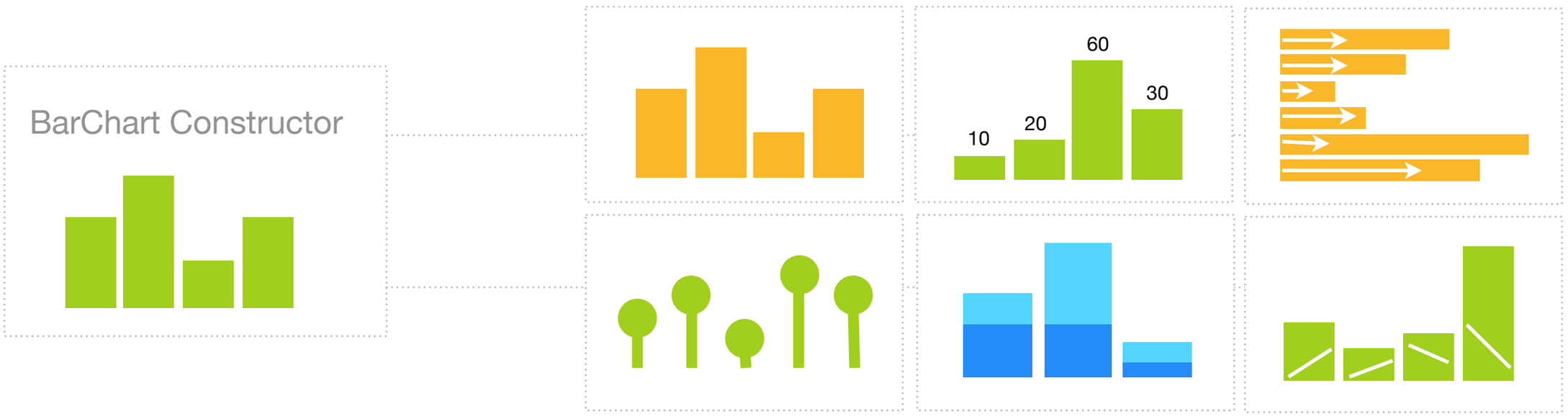
Easy to appropriate for a specific task



Difficulty level:

Extensible

Easy to extend with additional functionality



What is a reusable chart?

Difficulty level:

Composable

Easy to combine into other charts

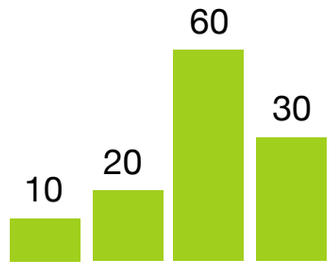
BarChart Constructor

+

Label Constructor

10 20 60 30

=



d3.Chart

http://misoproject.com/d3-chart

http://github.com/misoproject/d3.chart

Mike Pennisi
@jugglinmike

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var chart1 = d3.select("#vis")
  .append("svg")
  .attr("height", 200)
  .attr("width", 200)
  .chart("CircleChart")
  .color("orange");

chart1.draw([1,3,7,8,11,12.5,14]);
```

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d3.chart("CircleChart", {
  initialize: function() {
  },
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      }
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      insert: function() {
        return this.append("circle");
      },
      events : {
        "enter": function() {
          var chart = this.chart();
          this.attr("cy", 100)
            .attr("cx", function(d) {
              return chart.xScale(d);
            })
            .attr("r", 5)
            .style("fill", chart.color());
        },
        "exit:transition": function() {
          this.style("fill-opacity", 0)
            .remove();
        }
      }
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chart1.draw([1,3,7,8,11,12.5,14]);
```

Repeatable

```
var chart1 = d3.select("#vis")
  .append("svg")
  .attr("height", 200)
  .attr("width", 200)
  .chart("CircleChart");

chart1.draw([1,2,4]);
```

```
var chart2 = d3.select("#vis2")
  .append("svg")
  .attr("height", 1000)
  .attr("width", 1000)
  .chart("CircleChart");

chart2.draw([10,20,400]);
```

Configurable

```
var chart1 = d3.select("#vis")
  .append("svg")
  .attr("height", 200)
  .attr("width", 200)
  .chart("CircleChart")
  .color("orange");

chart1.draw(data);
```

```
var chart2 = d3.select("#vis")
  .append("svg")
  .attr("height", 200)
  .attr("width", 200)
  .chart("CircleChart")
  .color("blue");

chart2.draw(data);
```

Extensible

```
d3.chart("CircleChart").extend("CirclesWithBordersChart", {
  initialize: function() {
    this.layer("circles").on("enter", function() {
      this.style("stroke", "1px");
    });
  }
});
```

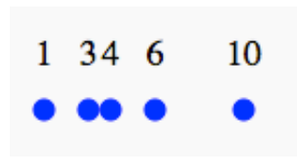
Extensible

```
d3.chart("CircleChart").extend("CirclesWithNumbersChart", {
  initialize: function() {
    this.layer("labels", this.base.append("g"), {
      dataBind: function(data) {
        return this.selectAll("text")
        .data(data);
      },
      insert: function() {
        return this.append("text");
      },
      events: {
        enter: function() {
          var chart = this.chart();
          return this.attr("x", function(d) {
            return chart.xScale(d);
          })
          .attr("y", 80)
          .style("text-anchor", "middle")
          .text(String);
        }
      }
    });
  }
});
```

Extensible

```
d3.chart("CircleChart").extend("CirclesWithNumbersChart", {
  initialize: function() {
    this.layer("labels", this.base.append("g"), {
      dataBind: function(data) {
        return this.selectAll("text")
        .data(data);
      },
      insert: function() {
        return this.append("text");
      },
      events: {
        enter: function() {
          var chart = this.chart();
          return this.attr("x", function(d) {
            return chart.xScale(d);
          })
          .attr("y", 80)
          .style("text-anchor", "middle")
          .text(String);
        }
      }
    });
  }
});
```

```
var chart1 = d3.select("#vis")
  .append("svg")
  .attr("height", 200)
  .attr("width", 200)
  .chart("CirclesWithNumbersChart")
  .color("blue");
```



Composable

```
d3.chart("CircleChart", {
  initialize: function() {
    this.layer("circles", this.base.append("g"), {
      // other layer instructions...
      events : {
        enter: function() {
           this.attr("cy", 100)
              .attr("cx", function(d) {
                  return d * 10;
               })
              .attr("r", 5)
              .style("fill", this.chart().fill());
        }
      }
    });
  },
  color: function(newFill) {
    if (arguments.length === 0) {
      return this._fill;
    }
    this._fill = newFill;
    return this;
  }
});
```

```
1  34  6    10
```

```
d3.chart("LabelsChart", {
  initialize: function() {
    this.layer("labels", this.base.append("g"), {
      dataBind: function(data) {
         return this.selectAll("text")
           .data(data);
      },
      insert: function() {
         return this.append("text");
      },
      events: {
        enter: function() {
          this.attr("x", function(d) {
              return d * 10;
            })
            .attr("y", 80)
            .style("text-anchor", "middle")
            .text(function(d) { return d; });

        }
      }
    });
  }
});
```

Composable

```
d3.chart("CLChart", {
  initialize: function() {
    var circles = this.base.append("g")
      .chart("CircleChart");
    );
    var labels = this.base.append("g")
      .chart("LabelsChart");
    );
    this.attach("circles", circles);
    this.attach("labels", labels);
  }
});
```

Composable

```
d3.chart("CLChart", {
  initialize: function() {
    var circles = this.base.append("g")
      .chart("CircleChart");
    );
    var labels = this.base.append("g")
      .chart("LabelsChart");
    );
    this.attach("circles", circles);
    this.attach("labels", labels);
  }
});
```

```
var chart1 = d3.select("#vis")
  .append("svg")
  .attr("height", 200)
  .attr("width", 200)
  .chart("CLChart");
```

```
chart1.draw(data);
```

Code walkthrough
the interesting bits

https://github.com/misoproject/d3.chart/blob/master/src/chart.js#L212-L230

https://github.com/misoproject/d3.chart/blob/master/src/layer.js#L124-L204

Why not

http://bost.ocks.org/mike/chart/

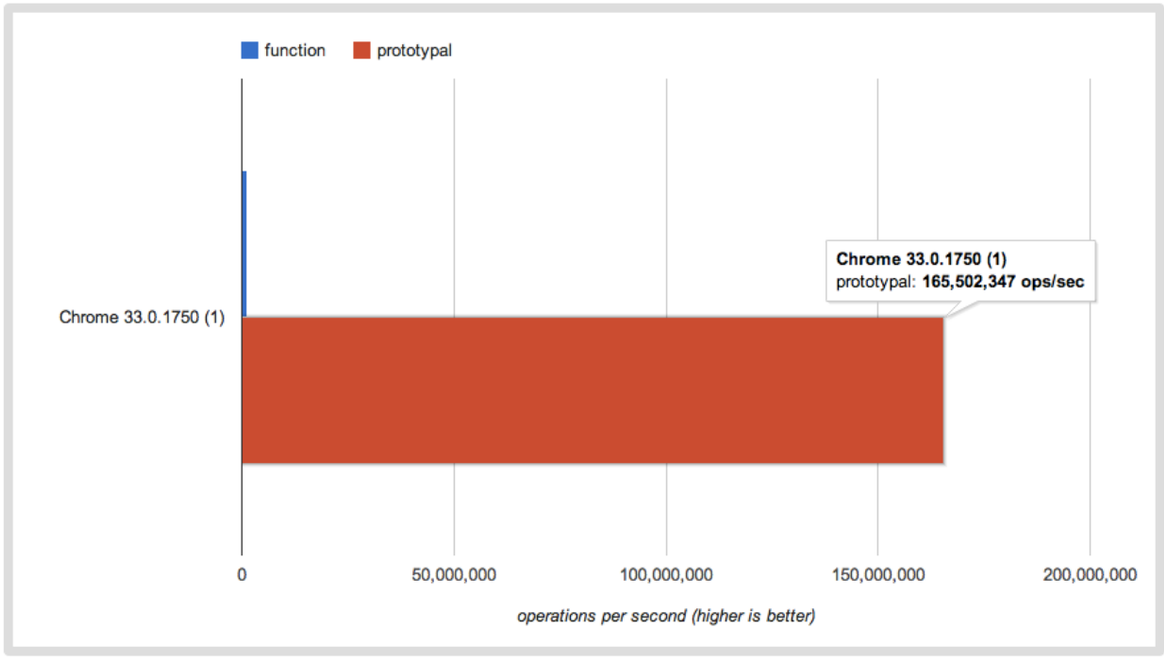
- Lifecycle selections are not accessible (hard to extend)
- The internal breakdown of graphical elements is still left to you
  (http://bost.ocks.org/mike/chart/time-series-chart.js)
- Prototypal inheritance is great in some cases (think 100 sparklines in a table)

It really all depends on what you need...

Prototypal Inheritance vs Closures w getter-setter methods

http://jsperf.com/prototypal-vis-fn

Testing in Chrome 33.0.1750.149 on OS X 10.9.2		
Test		**Ops/sec**
function	`chart();`	1,442,470 ±4.50% 99% slower
prototypal	`new chart2();`	170,912,189 ±3.27% fastest




```
function chart() {
  var width = 720, // default width
    height = 80; // default height

  function my() {
    // generate chart here, using `width` and `height`
  }

  my.width = function(value) {
    if (!arguments.length) return width;
    width = value;
    return my;
  };

  my.height = function(value) {
    if (!arguments.length) return height;
    height = value;
    return my;
  };

  return my;
}
```

```
function chart2() {
  this.width = 720;
  this.height = 80;
}

chart2.prototype.width = function(value) {
  if (!arguments.length) return this.width;
  this.width = value;
  return this;
};

chart2.prototype.height = function(value) {
  if (!arguments.length) return this.height;
  this.height = value;
  return this;
};
```

http://jsperf.com/closure-versus-prototypal-pattern-deathmatch

http://es5.github.io/#x4.2.1

Where we're at...

- Some charts published
  (http://misoproject.com/d3-chart/charts.html)

- A bunch of charts to be released with better gallery & discovery support

- d3.chart.base - common functionality across charts.
  (http://github.com/iros/d3.chart.base)

We're working on...

- Decorators
- Chained transitions
- Hooking into the draw loop
- ...You tell me!

What are **YOUR** d3 patterns?

THANK YOU!

Irene Ros
@ireneros