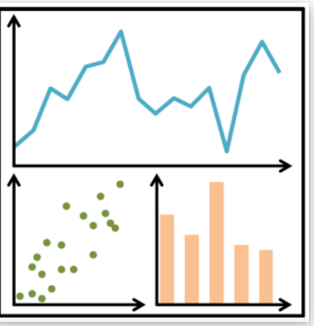
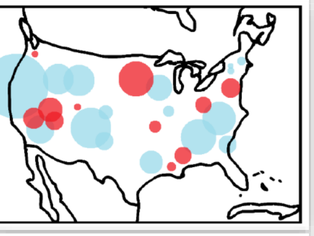
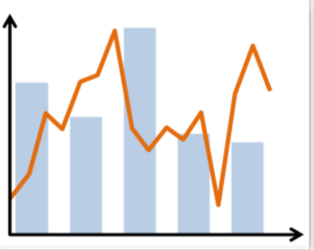
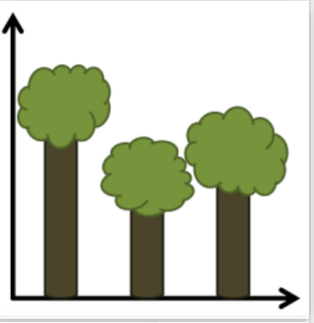
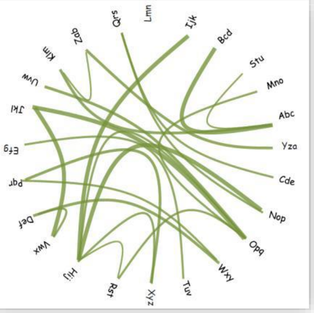






Lecture 6: D3

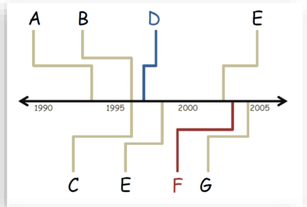
CS 7250

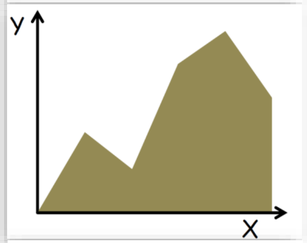
SPRING 2021

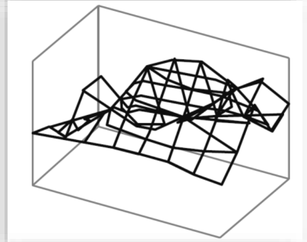
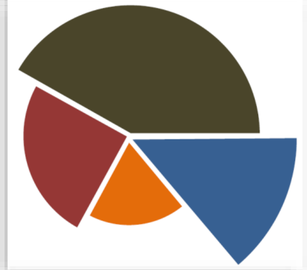
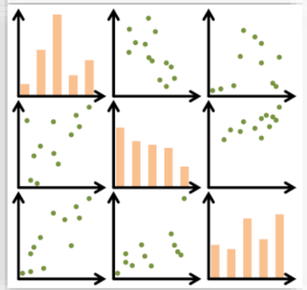
Prof. Cody Dunne

NORTHEASTERN UNIVERSITY

Slides and inspiration from Michelle Borkin, Krzysztof Gajos, Hanspeter Pfister, Miriah Meyer, Jonathan Schwabish, and David Sprague





Checking In

Previously, on CS 7250…

Attribute Types

➔ Categorical

e.g.,
fruit (apple, pear, grape),
colleges (CAMD, Khoury, COE)

➔ Ordered

➔ *Ordinal*

e.g.,
sizes (xs, s, m, l, xl),
months (J, F, M)

➔ *Quantitative* *(continuous)*

e.g.,
lengths (1’, 2.5’, 5’),
population

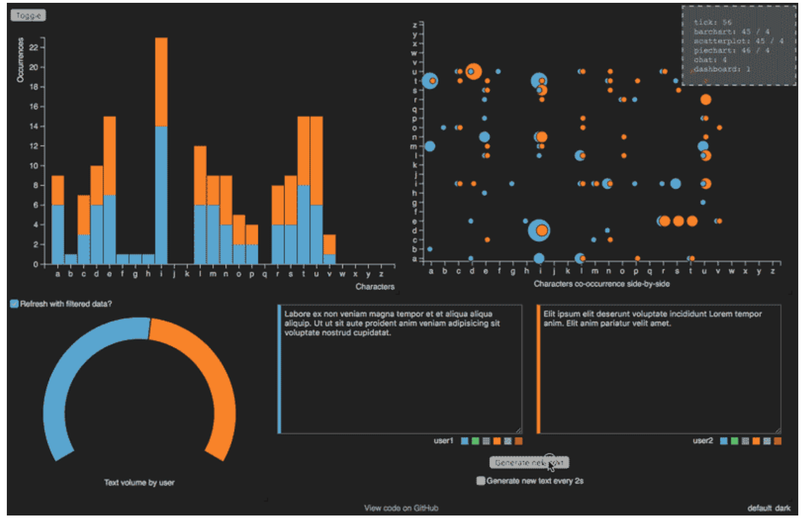
Now, on CS 7250…

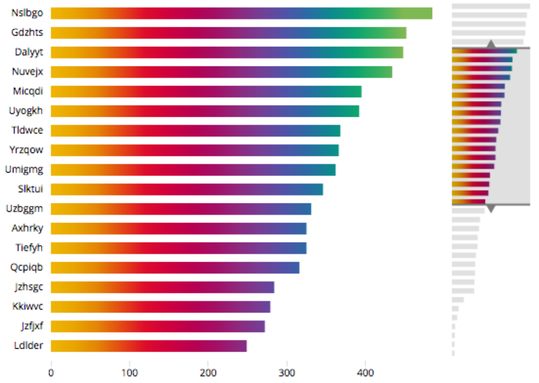
D3 Tutorial

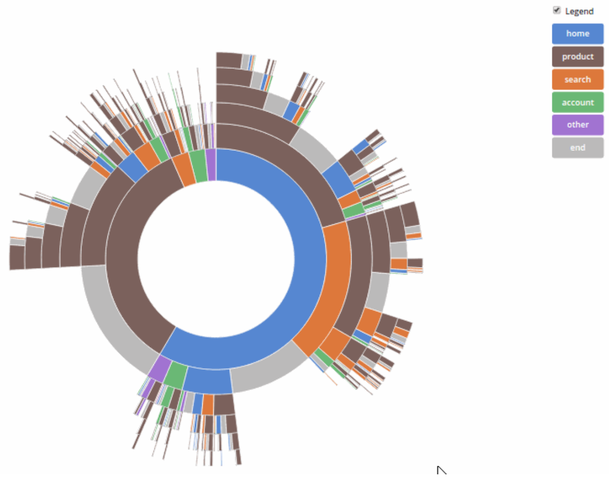
Data Driven Documents

	A	B	C	D	E	F	G
1	Code	Name	Population	% with Health Care Coverage	% Adult current smokers	% Overweight	%Obese
2	AK	Alaska	710231	82.4	20.4	40.7	25.2
3	AL	Alabama	4779736	83.8	21.9	37.0	33.0
4	AR	Arkansas	2915918	78.7	22.9	36.3	30.9
5	AZ	Arizona	6392017	89.5	13.5	40.7	24.7
6	CA	California	37253956	82.2	12.1	36.9	24.7
7	CO	Colorado	5029196	83.6	16.0	36.2	21.4
8	CT	Connecticut	3574097	90.2	13.2	37.5	23.0
9	DC	District of Columbia	601723	93.5	14.8	34.8	22.7
10	DE	Delaware	897934	90.0	17.3	35.3	28.7
11	FL	Florida	18801310	83.0	17.1	37.8	27.2
12	GA	Georgia	9687653	83.7	17.6	35.3	30.4
13	HI	Hawaii	1360301	93.2	14.5	34.1	23.1
14	IA	Iowa	3046355	89.6	16.1	37.1	29.1
15	ID	Idaho	1567582	80.9	15.7	36.0	26.9
16	IL						28.7
17	IN						30.2
18	KS						30.1
19	KY						31.8
20	LA						31.7

Month	Salesman	Region	Product	No. Customers	Net Sales	Profit / Loss
Jan-07	Joseph	North	FastCar	8	1,592	563
Jan-07	Joseph	North	RapidZoo	8	1,088	397
Jan-07	Joseph	West	SuperGlue	8	1,680	753
Jan-07	Joseph	West	FastCar	9	2,133	923
Jan-07	Joseph	West	RapidZoo	10	1,610	579
Jan-07	Joseph	Middle	SuperGlue	10	1,540	570
Jan-07	Joseph	Middle	FastCar	7	1,316	428
Jan-07	Joseph	Middle	RapidZoo	7	1,799	709
Jan-07	Lawrence	North	SuperGlue	8	1,624	621
Jan-07	Lawrence	North	FastCar	6	726	236
Jan-07	Lawrence	North	RapidZoo	9	2,277	966
Jan-07	Lawrence	West	SuperGlue	6	714	221
Jan-07	Lawrence	West	FastCar	9	2,682	1,023
	Lawrence	West	RapidZoo	6	1,500	634







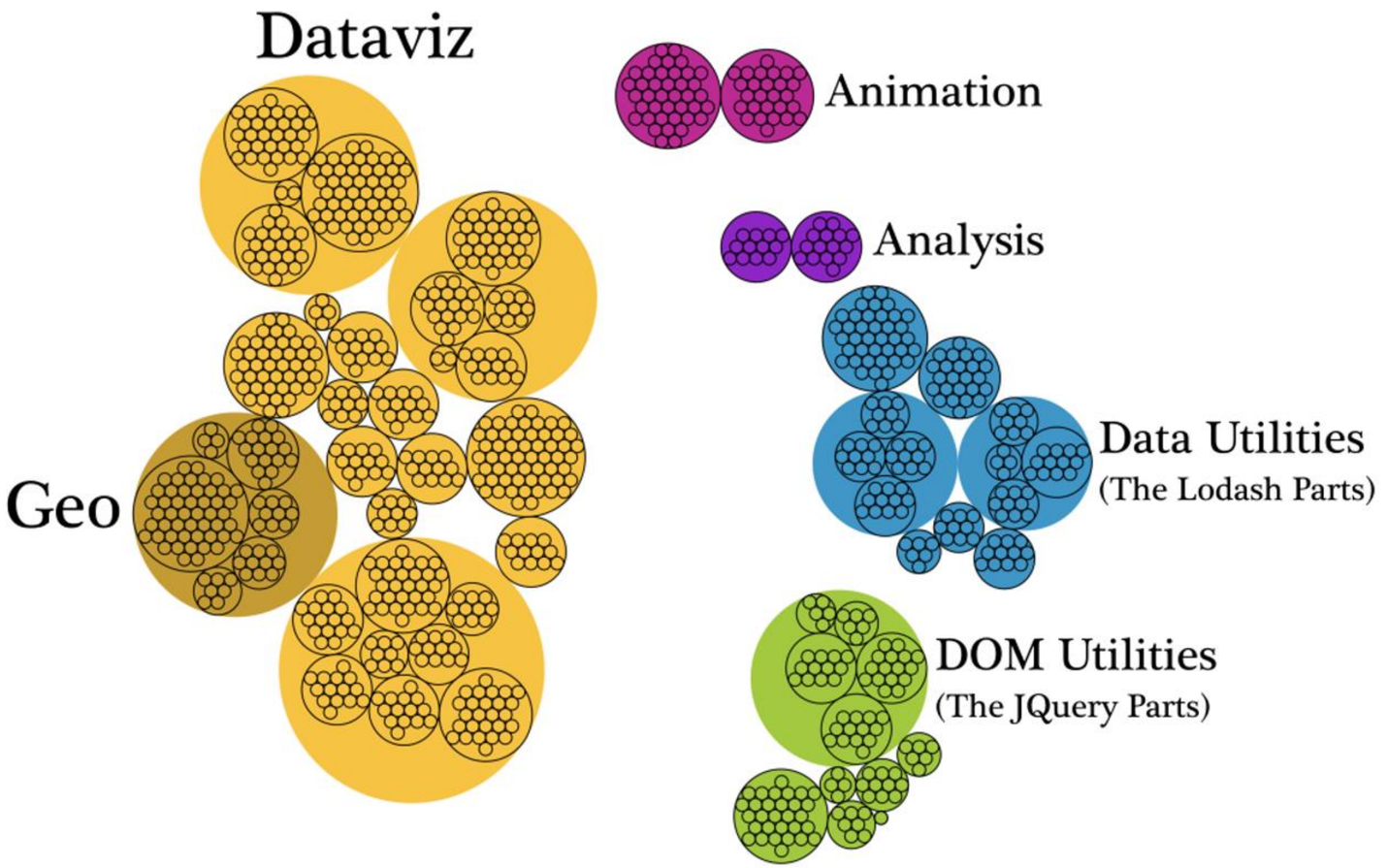
Data Driven Documents

- https://d3js.org/
- D3 is a javascript library to manipulate documents based on data.

→ **not** a data visualization library (it's not like plotly, matplotlib, ...)

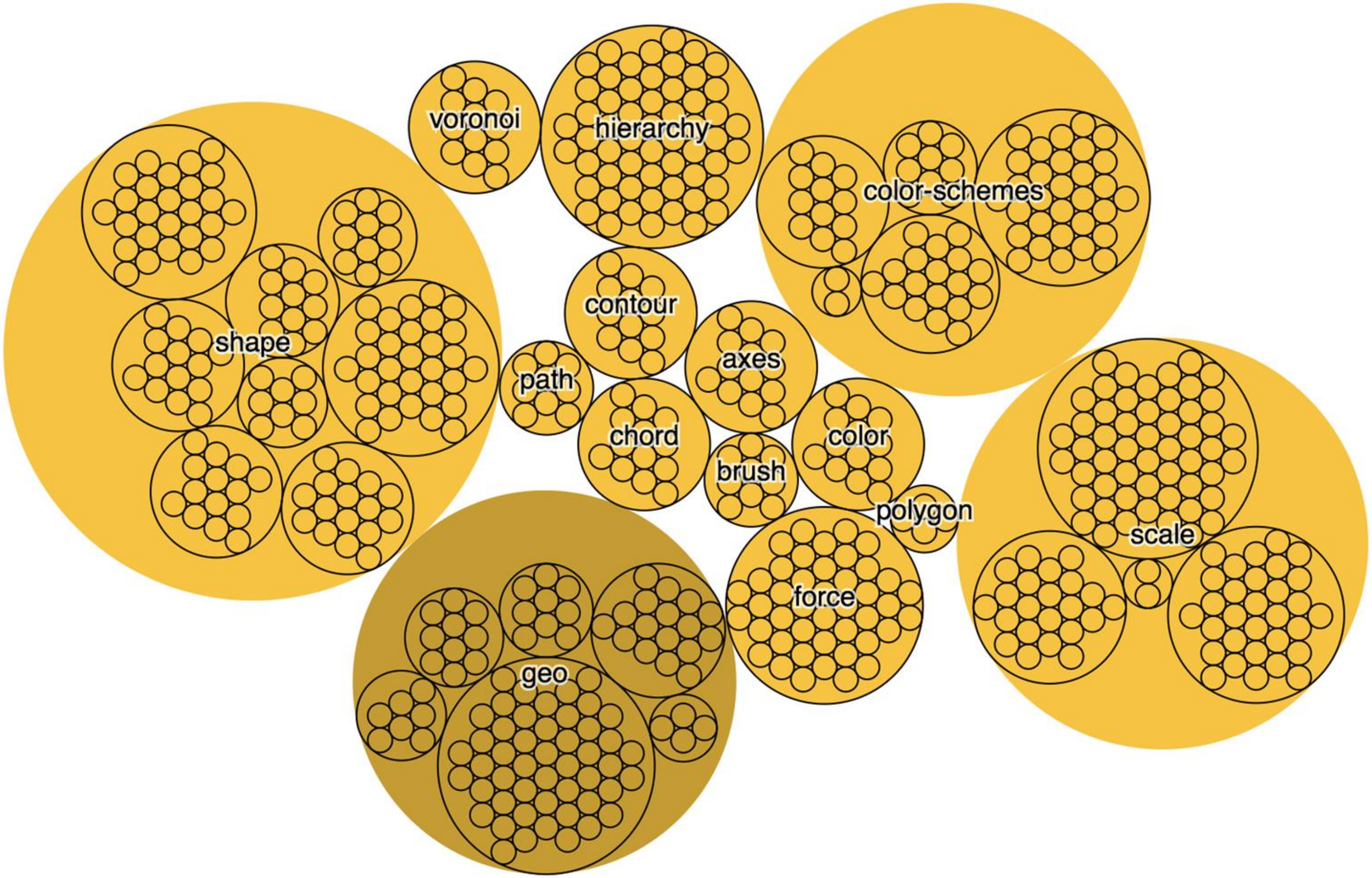
D3 is not a Data Visualization Library - Elijah Meeks

→ no out of the box charts (no functions to automatically build a chart)



The D3 API

Meeks, 2018


voronoi
hierarchy
color-schemes
shape
contour
axes
path
chord
color
brush
polygon
scale
force
geo

Meeks, 2018

Vector (svg) vs. raster (canvas, png, jpg, ...)

- Formulas that describe the lines and points that make up an image
- Independent from the size of an image
- Always looks crisp, no matter how much you zoom in or distort the picture
- Graphics in SVG will be heavier to process

- Describe the color content of each pixel
- Will appear blurry/pixelated if you zoom in too much

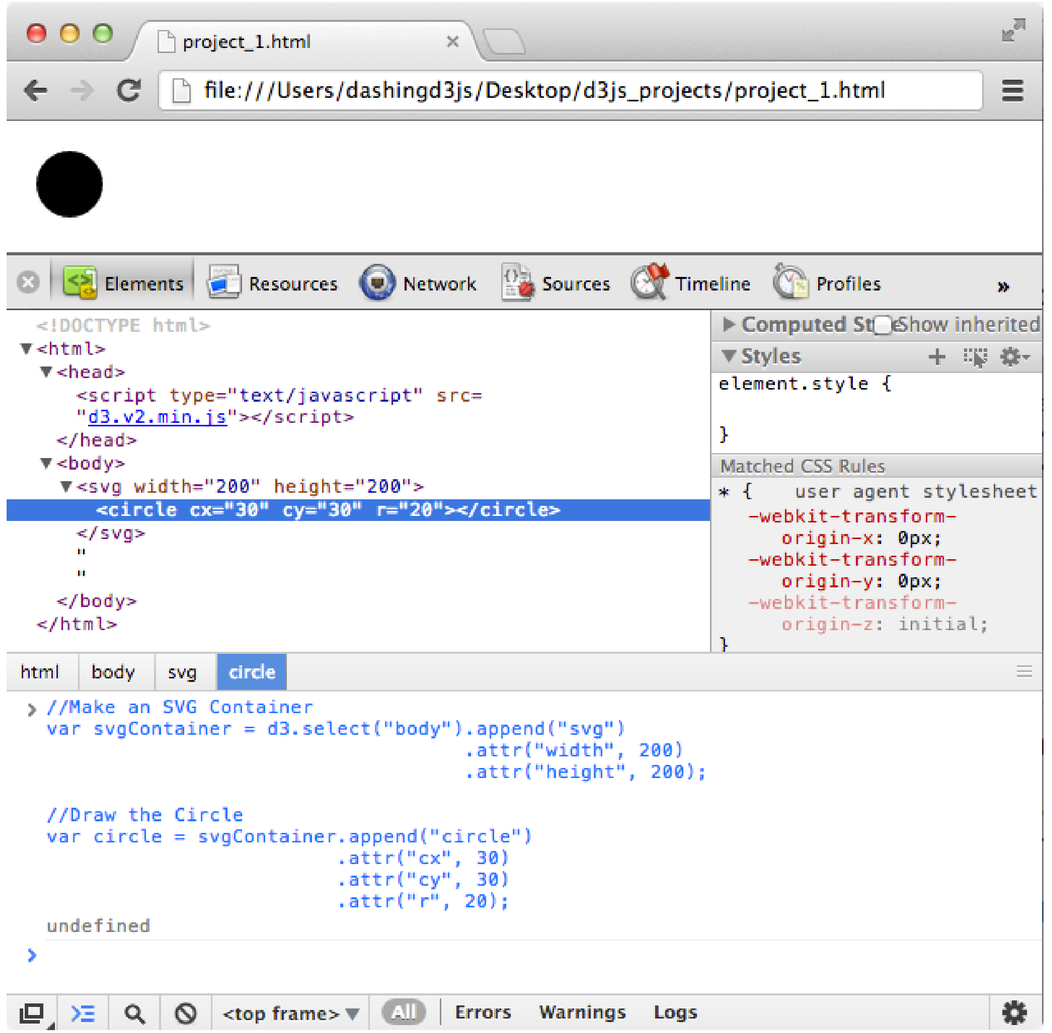
Minervini, 2017

SVG

- <svg> tag. E.g., <svg width='500' height='500'>
- can add <style> attributes
- Basic SVG shapes: rect, circle, line, text, polyline
- Can group elements using the <g> tag

```
svg = d3.select('body').append('svg')
    .attr('width', 200)
    .attr('height', 200)

var circle = svg.append('circle')
    .attr('cx', 30)
    .attr('cy', 30)
    .attr('r', 20)
    .attr('fill', 'black')
```



Example: drawing

Selections

Selections:

.select ('selectors’)

.selectAll ('selectors’)

```
.select('tagname')      // select by name of the element
.select('#id')          // select by id of the element
.select('.classname')   // select by class name
```

More info on selections: https://bost.ocks.org/mike/selection/

Example: selections-GoT

Data Binding

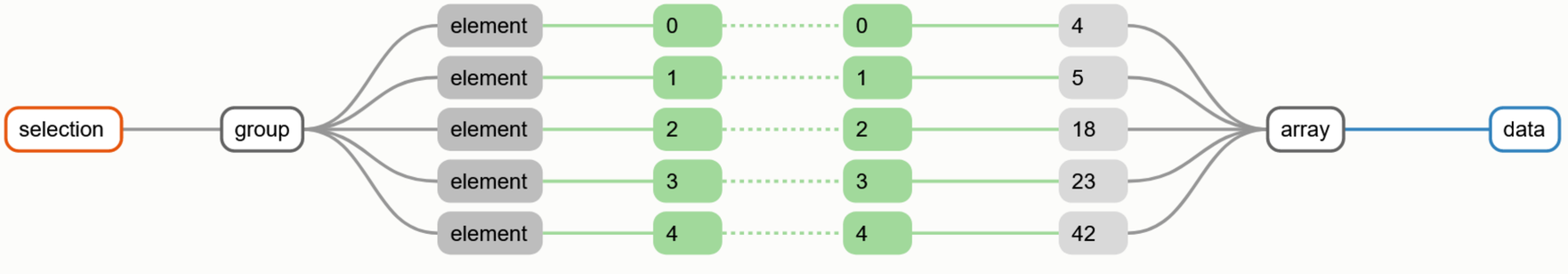
Data can be added in a number of different ways

Simplest way is through→ .data( )

The .data( ) method joins the current selection with entries in your dataset

Data Binding

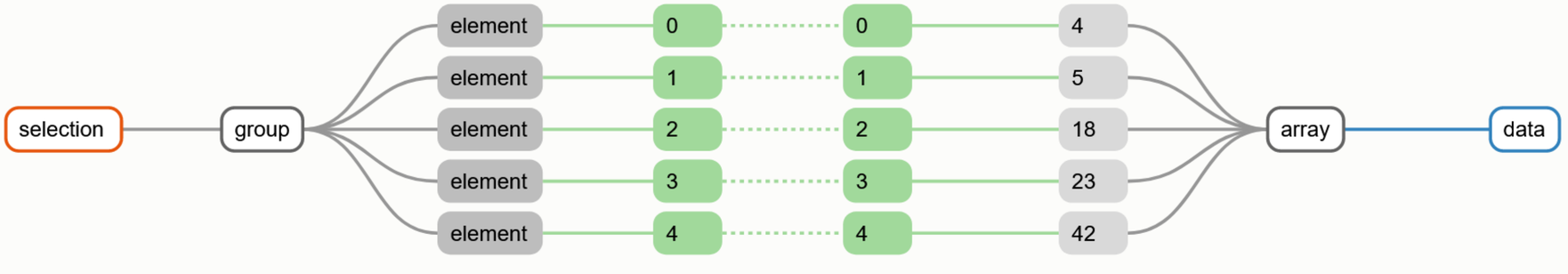
```
var numbers = [4, 5, 18, 23, 42];
```



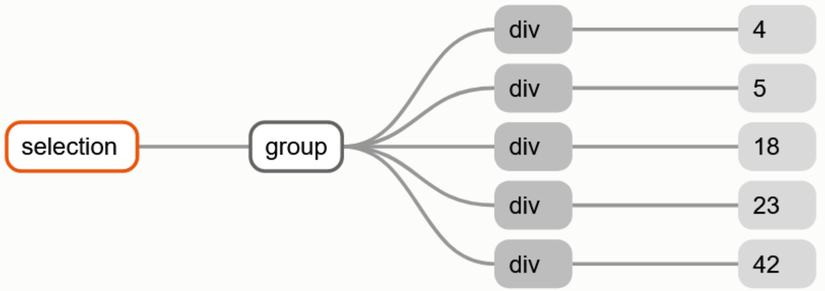
Bostock, 2013

Data Binding

```
var numbers = [4, 5, 18, 23, 42];
```




```
d3.selectAll("div").data(numbers);
```

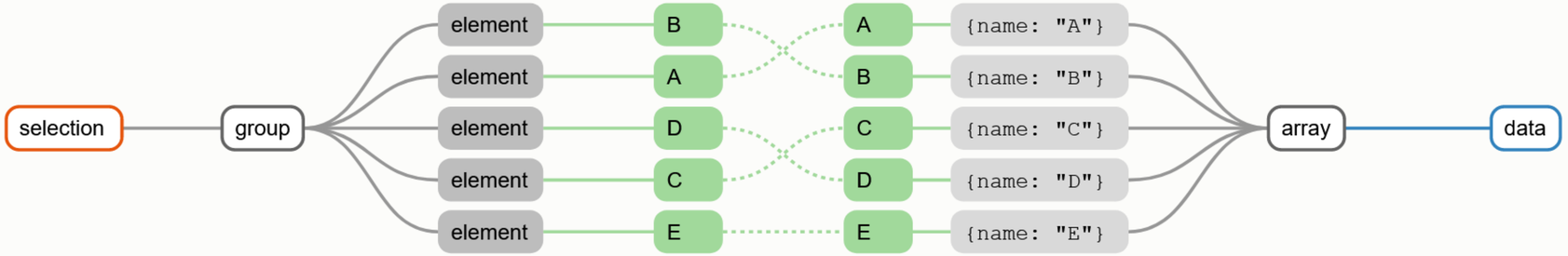


Bostock, 2013

Data Binding

```
var letters = [
  {name: "A", frequency: .08167},
  {name: "B", frequency: .01492},
  {name: "C", frequency: .02780},
  {name: "D", frequency: .04253},
  {name: "E", frequency: .12702}
];

function name(d) {
  return d.name;
}
```



Bostock, 2013

Data Binding

```
var letters = [
  {name: "A", frequency: .08167},
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  {name: "C", frequency: .02780},
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function name(d) {
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}
```
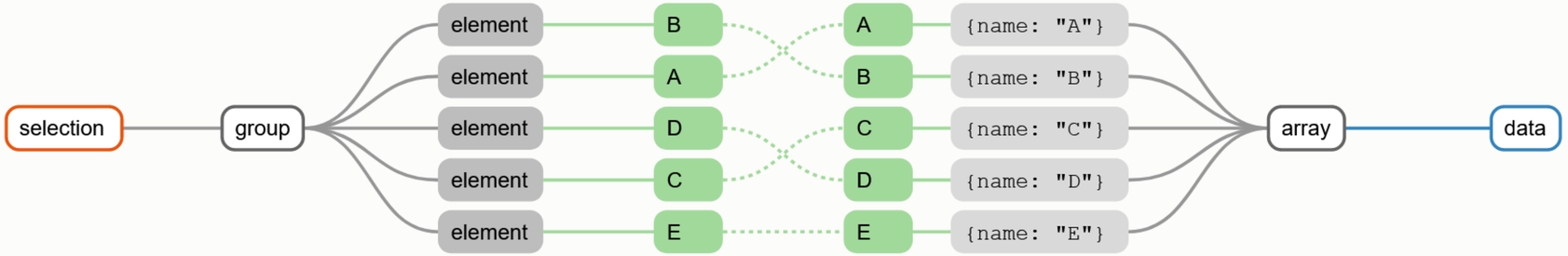
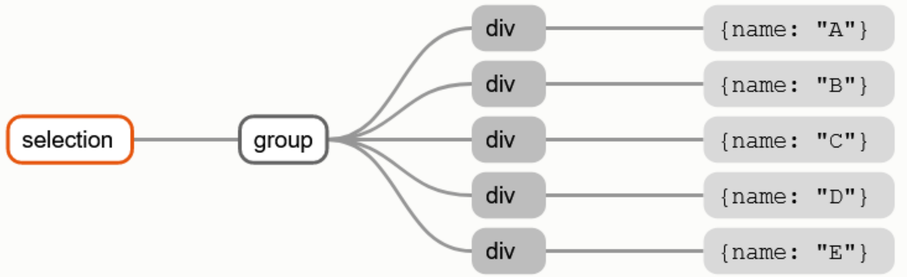




```
d3.selectAll("div").data(letters, name);
```



Bostock, 2013

Data Binding

If you ever get lost:

"How selections work:" https://bost.ocks.org/mike/selection/

Example: data_binding

Modifying Elements

- text( ) // changes the text of the selection
- html( ) // allows you to modify the html
- append( ) // add element to the last child of the selection
- insert( ) // adds element to a more specific position
- remove( ) // deletes element

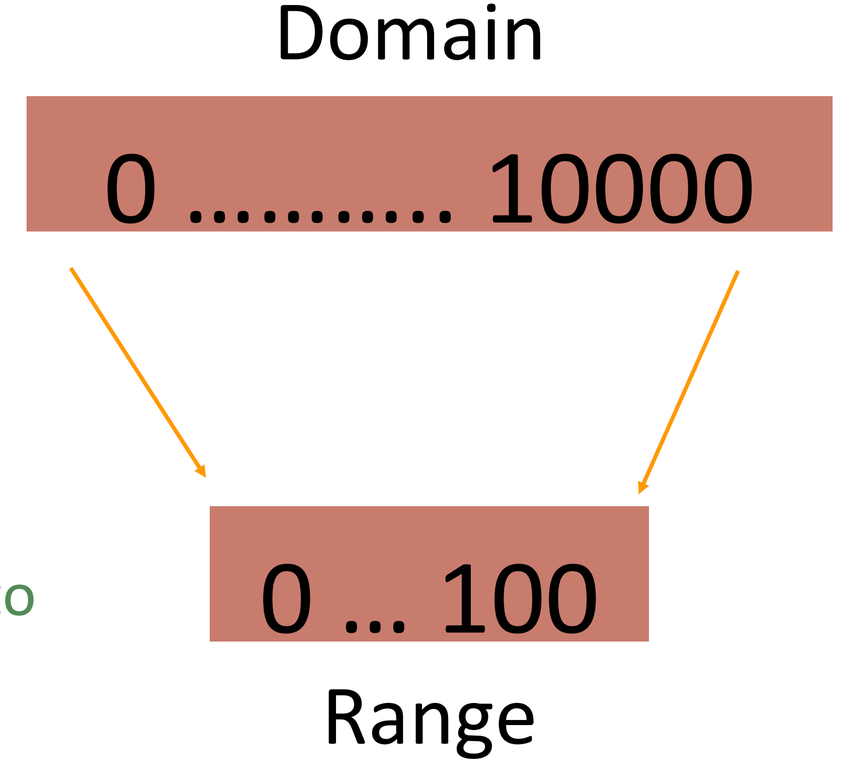
Controlling Attributes

- style( ) // gives access to any CSS styles
- classed( ) // allows you to toggle classes on and off
- attr( ) // allows you to access any attributes

Example: selections-GoT

Linear Scales

- scaleLinear( ) // Quantitative attributes
- domain( ) // Original values that you will modify
- range ( ) // Values that we want to scale our data to



➔ Ordered

➔ *Quantitative*

Ordinal Scales

- scaleBand( ) // categorical attributes
- domain( ) // original values that you will modify
- range ( ) // Values that we want to scale our data to
- padding() // e.g., to control the spacing in between the bars

➔ Categorical

➔ Ordered

➔ *Ordinal*

Barchart example

Example: barchart

Scatterplot example

Example: scatterplot

Interactivity

Events

- Call events with the on(event) handler
  - mouseover
  - mouseout etc.
- To target the element that dispatched the event use this keyword

Transitions

- .transition( ) // creates a transition
- .duration( ) // adding duration to the transition
- .delay( ) // effect is not going to take place until after this time

Example: transitions

Examples:

https://github.com/NEU-CS-7250-S21-Staff/D3_Examples

Upcoming Assignments & Communication

https://northeastern.instructure.com/courses/63405/assignments/syllabus

Look at the upcoming assignments and deadlines regularly!

- Textbook, Readings, & Reading Quizzes — Variable days
- In-Class Activities — 11:59pm same day as class
  - T: Continue lecture & in-class activity on D3 (2/2) (if necessary)
  - F: In-class project pitches
  - Next T: In-class project group finalizing & work
  - Next F: Lecture & in-class activity on Altair
- Assignments & Projects— Generally due R 11:59pm
  - R (6 days): Project 1 (pitches), Assignments 4a (critique) & 4b (Altair setup) due
  - Next R (13 days): Project 2 (proposals), Assignment 5 due (D3)

Everyday Required Supplies:

- 5+ colors of pen/pencil
- White paper
- Laptop and charger

Use Canvas Discussions for general questions, email the TAs/S-LTA/instructor for questions specific to you: codydunne-and-tas@ccs.neu.edu. Include links!