Interaction

DSC 106: Data Visualization

Sam Lau

UC San Diego

Announcements

Lab 5 due today

Project 3 checkpoint due Tuesday next week

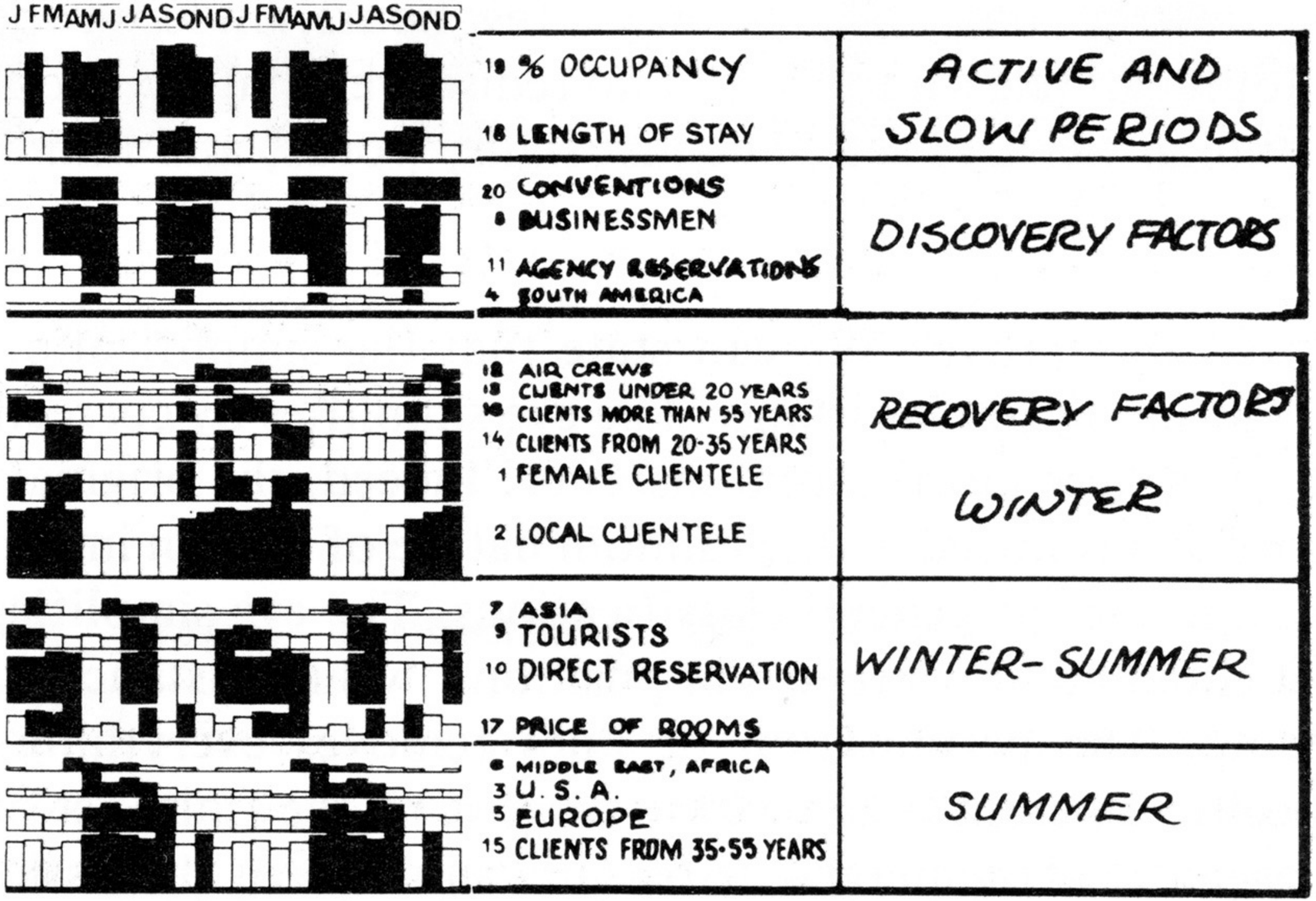
FAQs:

1. **What about the last step for the D3 demo from last lecture?** Probably won't cover during class, but I'll add a LOT of comments to the code next week to help understand it (in d3-lecture/weather05/main.js)

Example: Bertin's Hotel Data

J	F	M	A	M	J	J	A	S	O	N	D		
26	21	26	28	20	20	20	20	20	40	15	40	1	% CLIENTELE FEMALE
69	70	77	71	37	36	39	39	55	60	68	72	2	% —〃— LOCAL
7	6	3	6	23	14	19	14	9	6	8	8	3	% —〃— U.S.A.
0	0	0	0	8	6	6	4	2	12	0	0	4	% —〃— SOUTH AMERICA
20	15	14	15	23	27	22	30	27	19	19	17	5	% —〃— EUROPE
1	0	0	8	6	4	6	4	2	1	0	1	6	% —〃— M.EAST, AFRICA
3	10	6	0	3	13	8	9	5	2	5	2	7	% —〃— ASIA
78	80	85	86	85	87	70	76	87	85	87	80	8	% BUSINESSMEN
22	20	15	14	15	13	30	24	13	15	13	20	9	% TOURISTS
70	70	75	74	69	68	74	75	68	68	64	75	10	% DIRECT RESERVATIONS
20	18	19	17	27	27	19	19	26	27	21	15	11	% AGENCY ——〃——
10	12	6	9	4	5	7	6	6	5	15	10	12	% AIR CREWS
2	2	4	2	2	1	1	2	2	4	2	5	13	% CLIENTS UNDER 20 YEARS
25	27	37	35	25	25	27	28	24	30	24	30	14	% —〃— 20-35 —〃—
48	49	42	48	54	55	53	51	55	46	55	43	15	% —〃— 35-55 —〃—
25	22	17	15	19	19	19	19	19	20	19	22	16	% —〃— MORE THAN 55 —〃—
163	167	166	174	152	155	145	170	157	174	165	156	17	PRICE OF ROOMS
1.65	1.71	1.65	1.91	1.90	2.	1.54	1.60	1.73	1.82	1.66	1.44	18	LENGTH OF STAY
67	82	70	83	74	77	56	62	90	92	78	55	19	% OCCUPANCY
			X	X	X			X	X	X	X	20	CONVENTIONS

[Graphics and Graphic Information Processing, Bertin 81]


J FMAMJ JASONDJ FMAMJ JASOND
19 % OCCUPANCY
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ACTIVE AND SLOW PERIODS
20 CONVENTIONS
8 BUSINESSMEN
11 AGENCY RESERVATIONS
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DISCOVERY FACTORS
12 AIR CREWS
13 CLIENTS UNDER 20 YEARS
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1 FEMALE CLIENTELE
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RECOVERY FACTORS WINTER
7 ASIA
9 TOURISTS
10 DIRECT RESERVATION
17 PRICE OF ROOMS
WINTER-SUMMER
6 MIDDLE EAST, AFRICA
3 U.S.A.
5 EUROPE
15 CLIENTS FROM 35-55 YEARS
SUMMER

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20	18	19	17	27	27	19	19	26	27	21	15	11	% AGENCY ———〃———
10	12	6	9	4	5	7	6	6	5	15	10	12	% AIR CREWS
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25	22	17	15	19	19	19	19	19	20	19	22	16	% —〃— MORE THAN 55 —〃—
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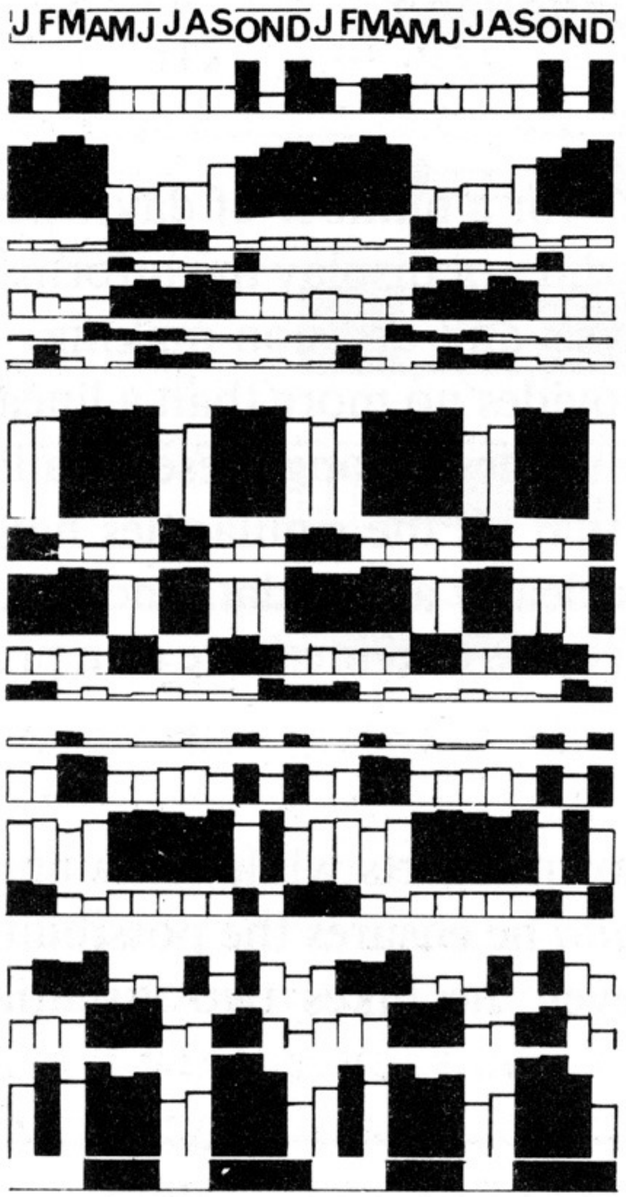

1	% CLIENTELE FEMALE
2	% —〃— LOCAL
3	% —〃— U.S.A.
4	% —〃— SOUTH AMERICA
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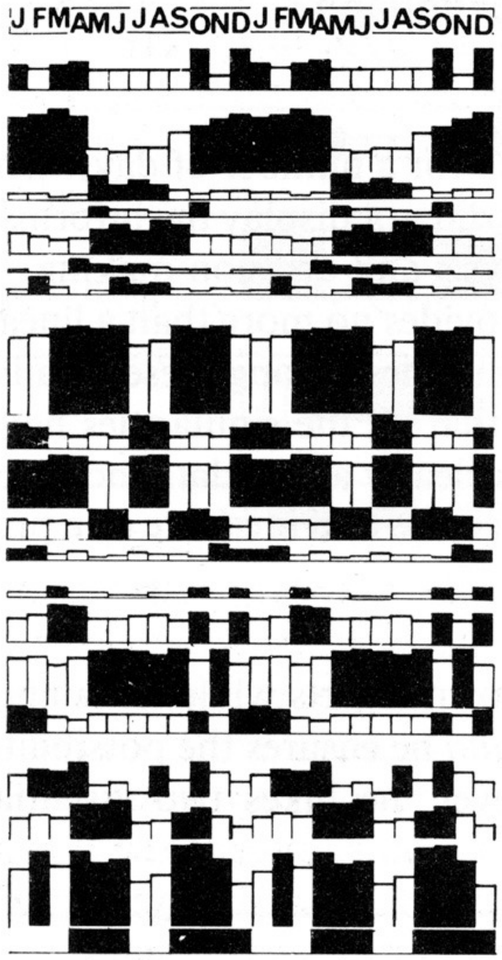

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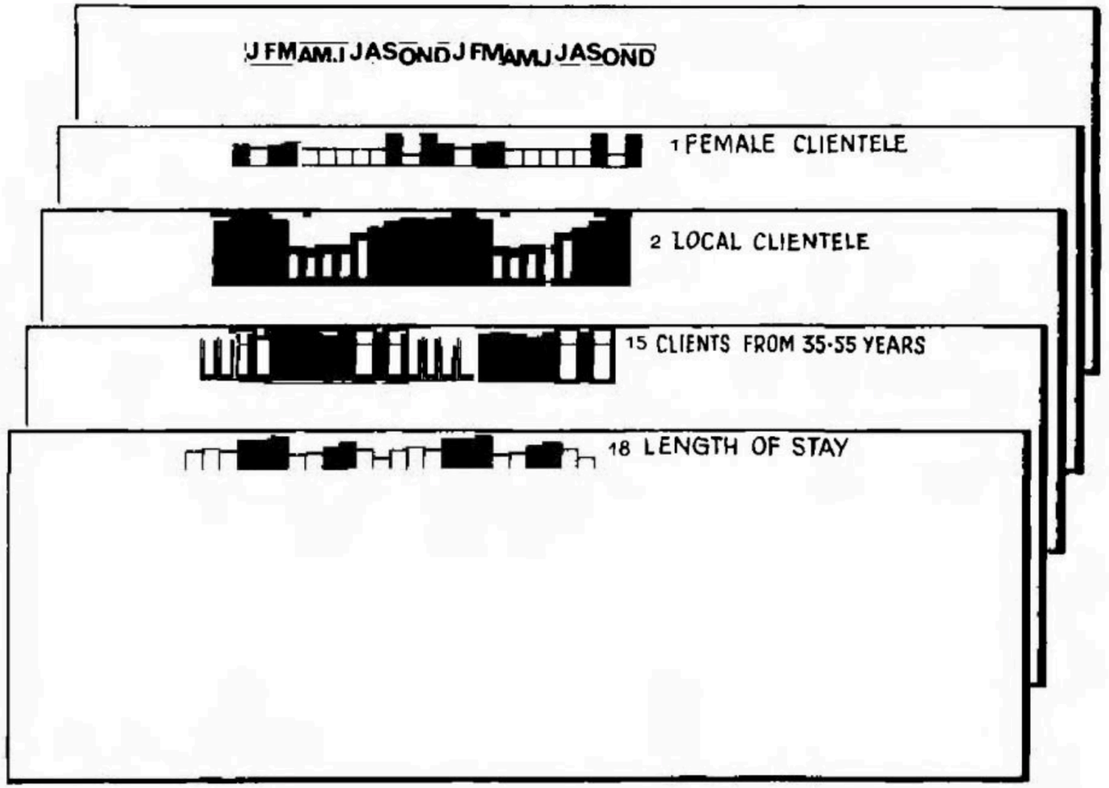

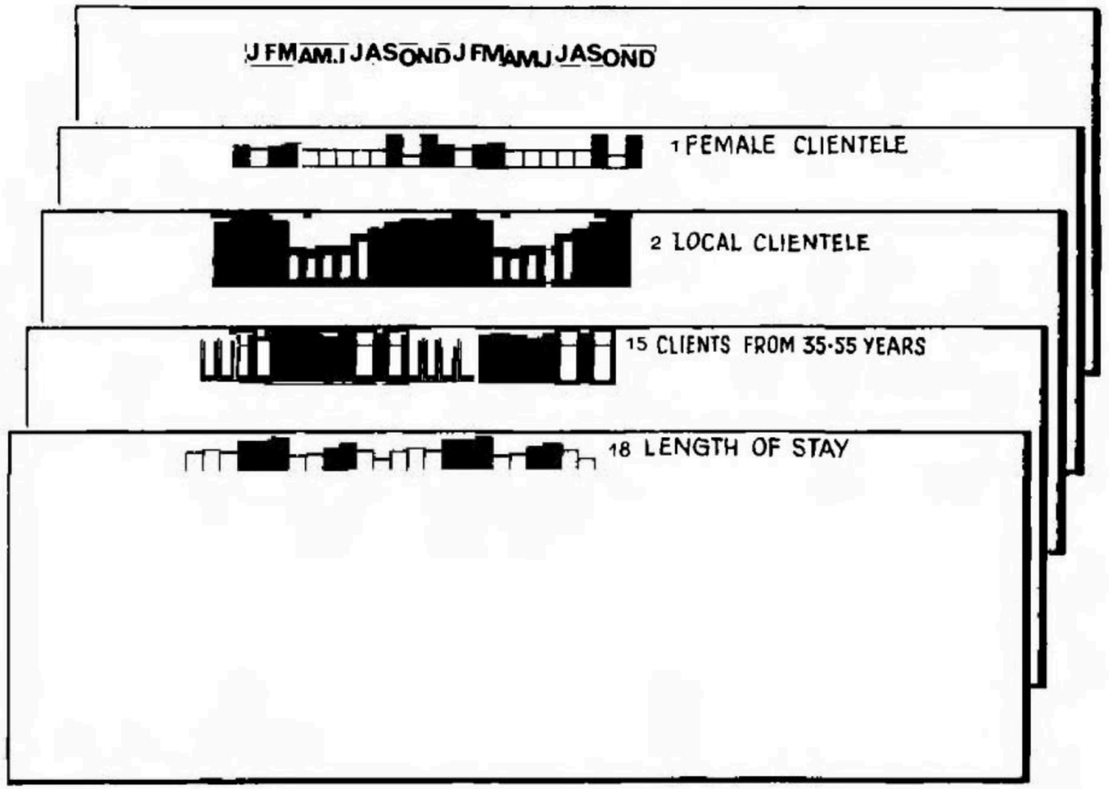
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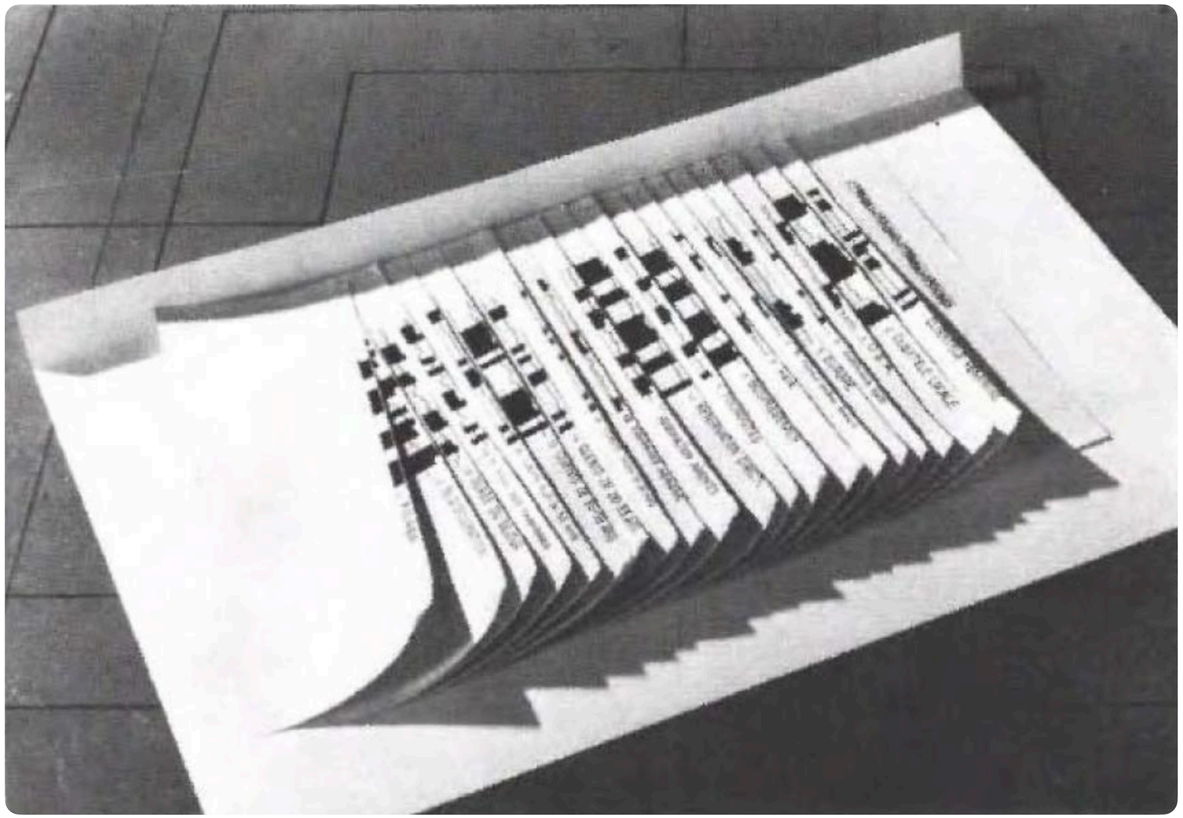

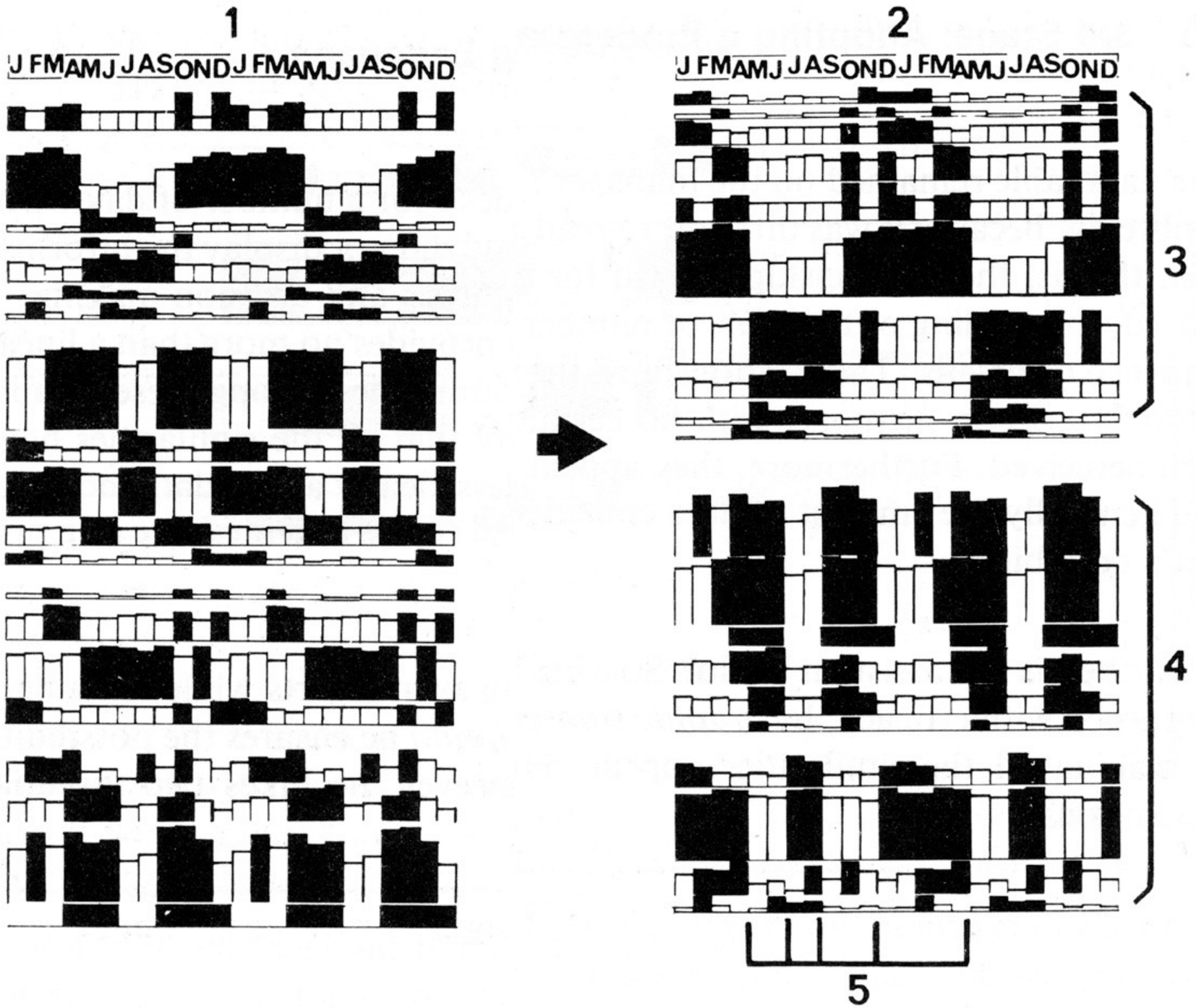
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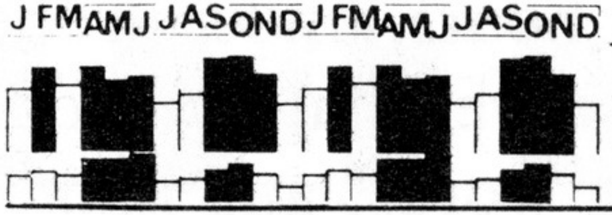

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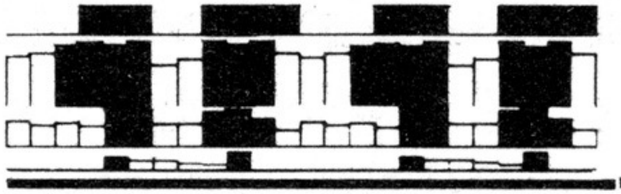

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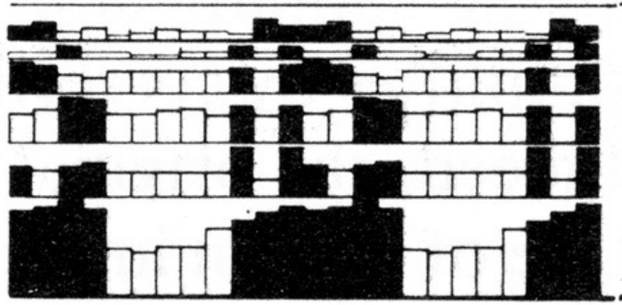

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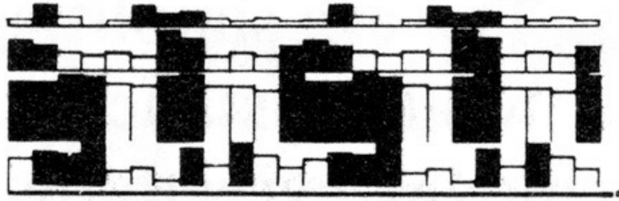

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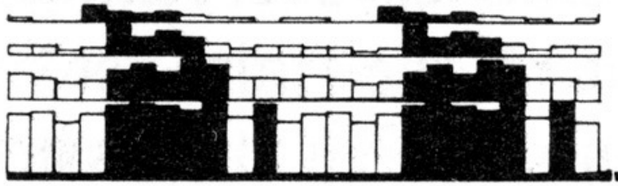

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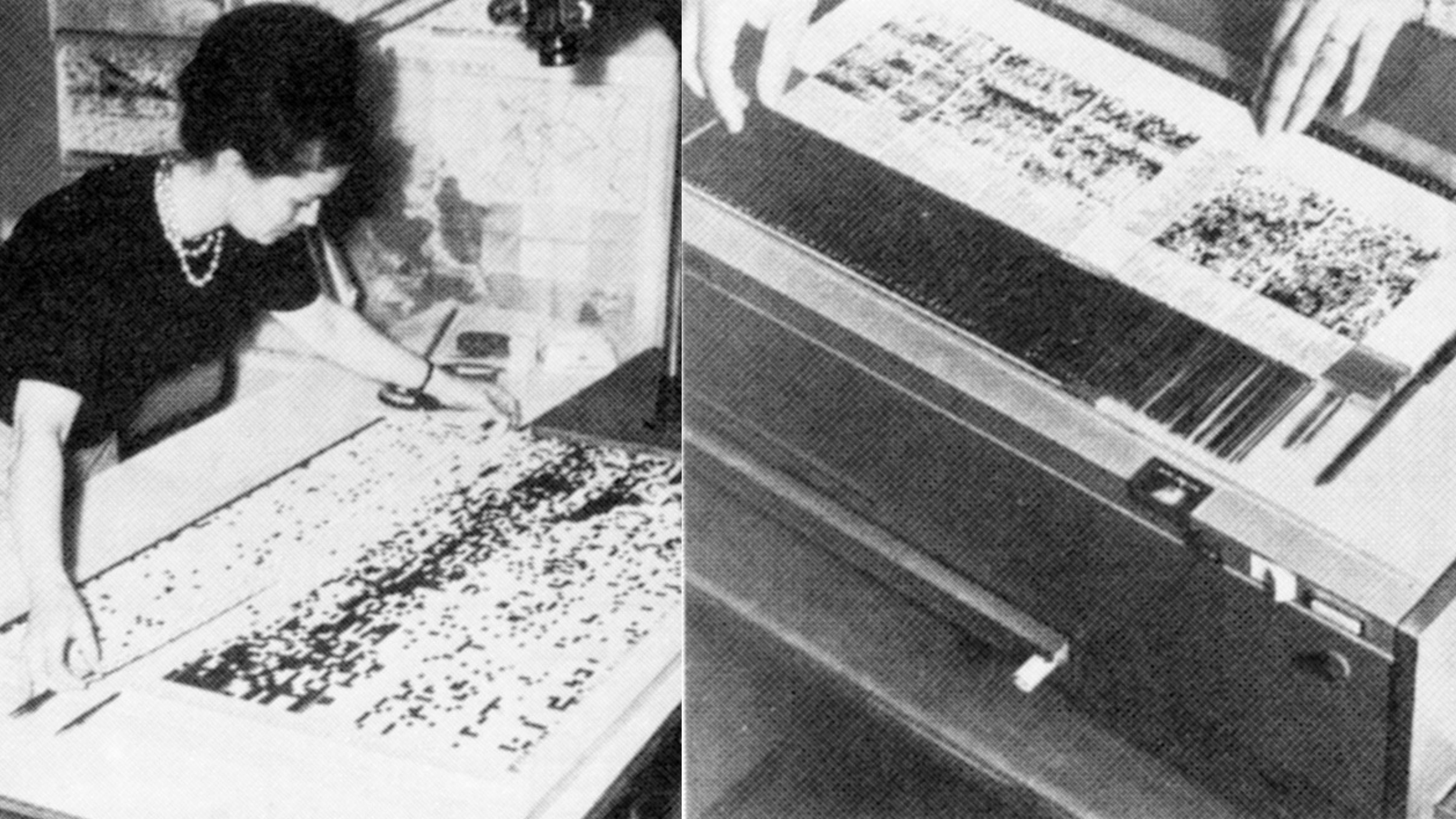

Gulf of Evaluation
The level of difficulty in interpreting the system and assessing if goals were met.

User Goals

Interface

Gulf of Execution
The gap between the user's goals and their ability to achieve them using the system.

Hutchins, Edwin L., James D. Hollan, and Donald A. Norman. "Direct manipulation interfaces." 1985.

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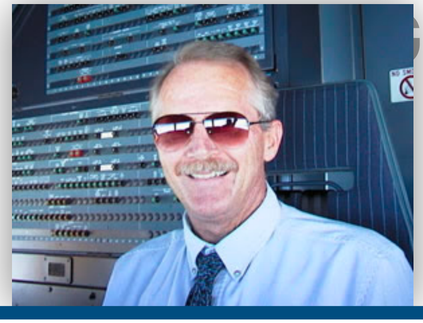
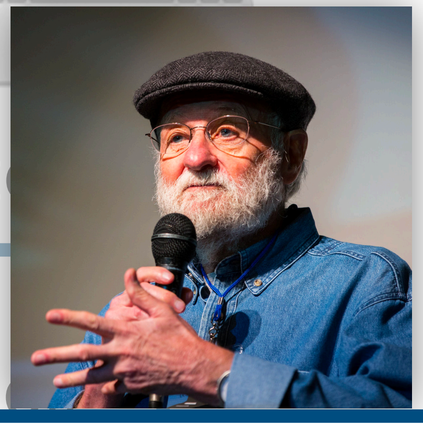


Edwin Hutchins

Jim Hollan



Don Norman

Gulf of Evaluation
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User Goals

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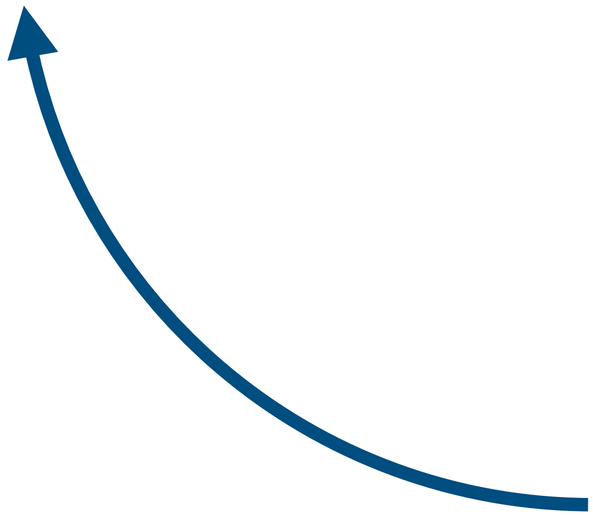
Hutchins, Edwin L., James D. Hollan, and Donald A. Norman. "Direct manipulation interfaces." 1985.

day	stock	price
10/3	AMZN	957.10
10/3	MSFT	74.26
10/4	AMZN	965.45
10/4	MSFT	74.69

```
pd.read_csv('stocks.csv')
```

day	symbol	price
10/3	AMZN	957.10
10/4	AMZN	965.45

```
df[df['price'] > 900]
```



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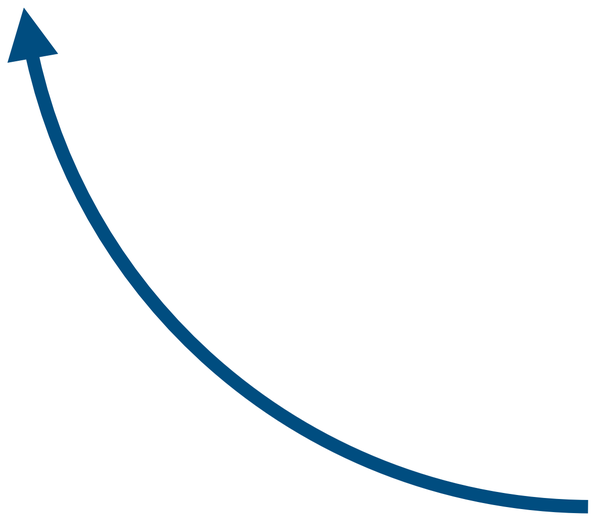

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```
df.sort_values('price',
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```

symbol	avg(price)
AMZN	961.275
MSFT	74.475

```
df.groupby('symbol')
.mean()
```

day	stock	price
10/3	AMZN	957.10
10/3	MSFT	74.26
10/4	AMZN	965.45
10/4	MSFT	74.69

```
pd.read_csv('stocks.csv')
```

Gulf of Evaluation

- Results returned as a table.
- No hint on how to reformulate query.
- Slow question-answer loop.

User Goals

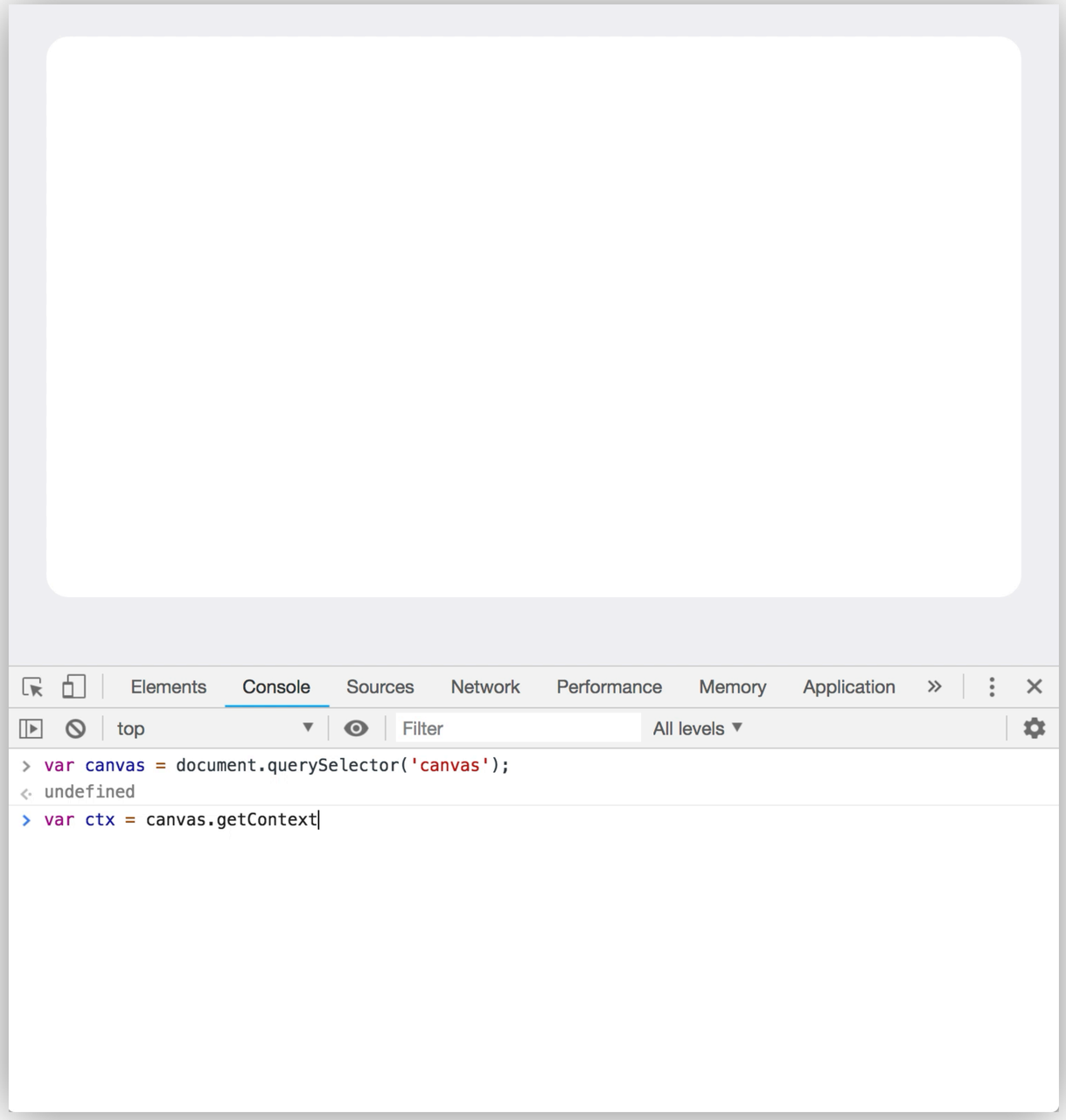
Python

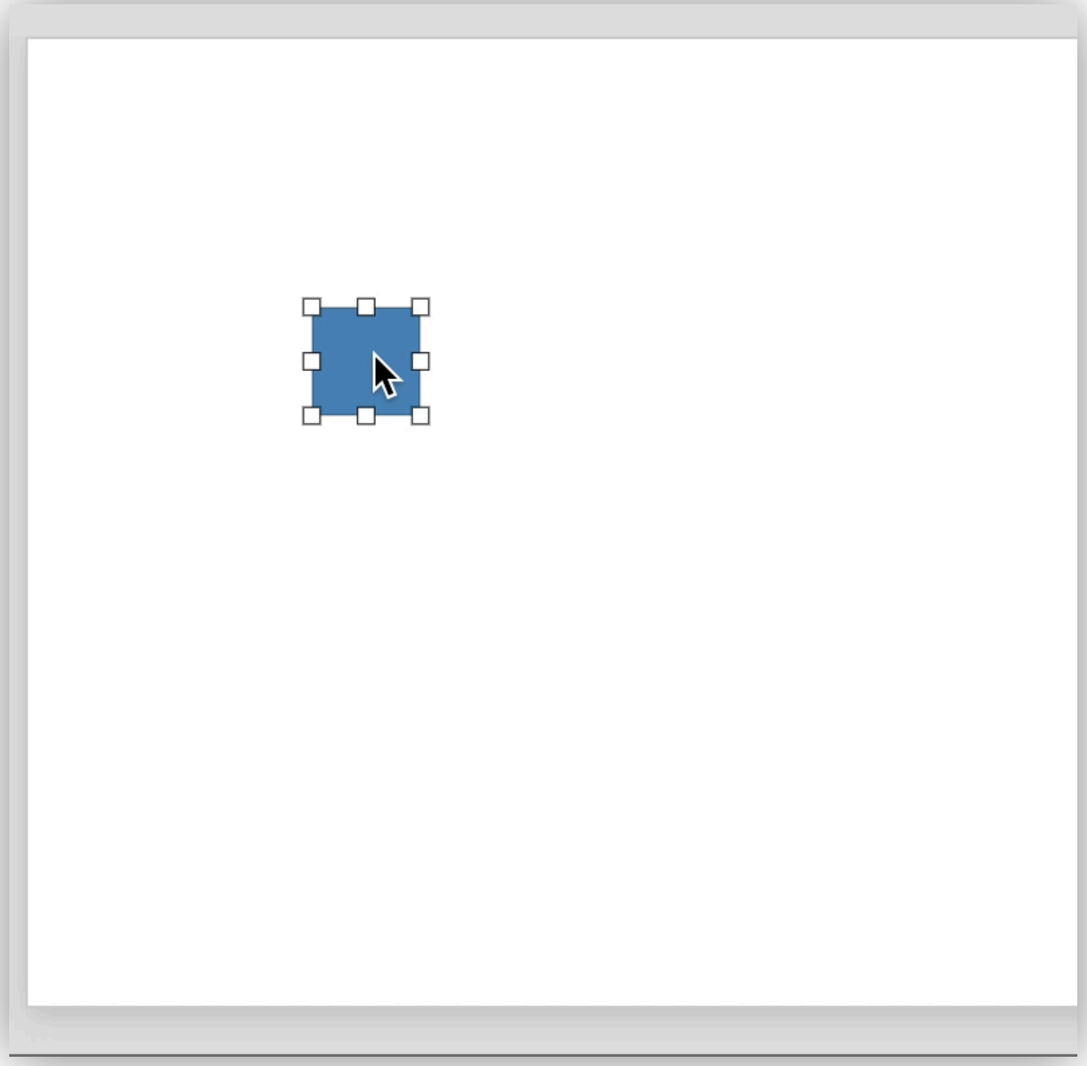
Interface

Gulf of Execution

- A rigid syntax designed by/for programmers.
- Difficult to do "fuzzy" matching.

Hutchins, Edwin L., James D. Hollan, and Donald A. Norman. "Direct manipulation interfaces." 1985.


Elements
Console
Sources
Network
Performance
Memory
Application
top
Filter
All levels
> var canvas = document.querySelector('canvas');
undefined
> var ctx = canvas.getContext



Gulf of Evaluation

- Visual representation of objects + actions.
- Immediate + continuous display of results.

User Goals

Direct Manipulation

Interface

Gulf of Execution

- Physical actions or labeled buttons instead of complex syntax.
- Rapid, incremental, and reversible actions.

Hutchins, Edwin L., James D. Hollan, and Donald A. Norman. "Direct manipulation interfaces." 1985.

Interaction in Visualization

Select	identify something as interesting.
Connect	show me something conditionally.
Abstract/Elaborate	show me related items.
Filter	show me more or less detail.
Reconfigure	show me a different arrangement.
Explore	show me something else.
Encode	show me a different visual representation.

Yi, Ji Soo, et al. "Toward a deeper understanding of the role of interaction in information visualization." 2007.

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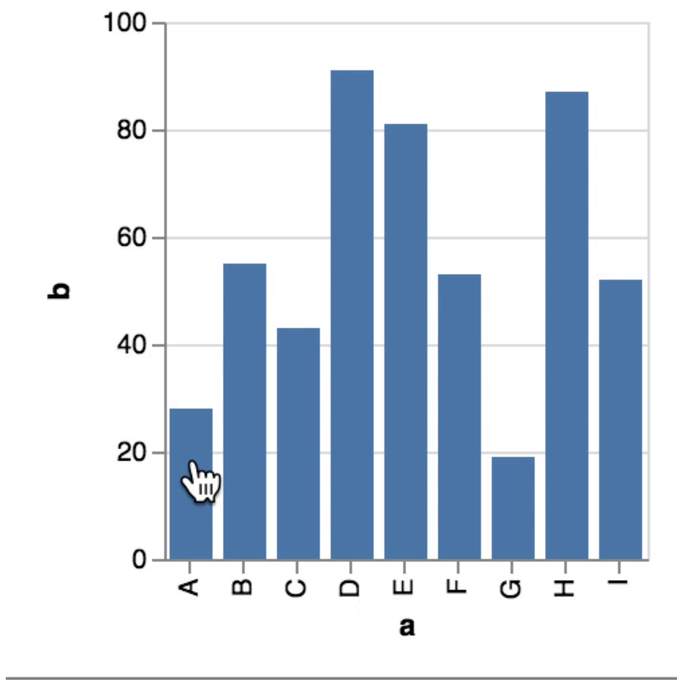
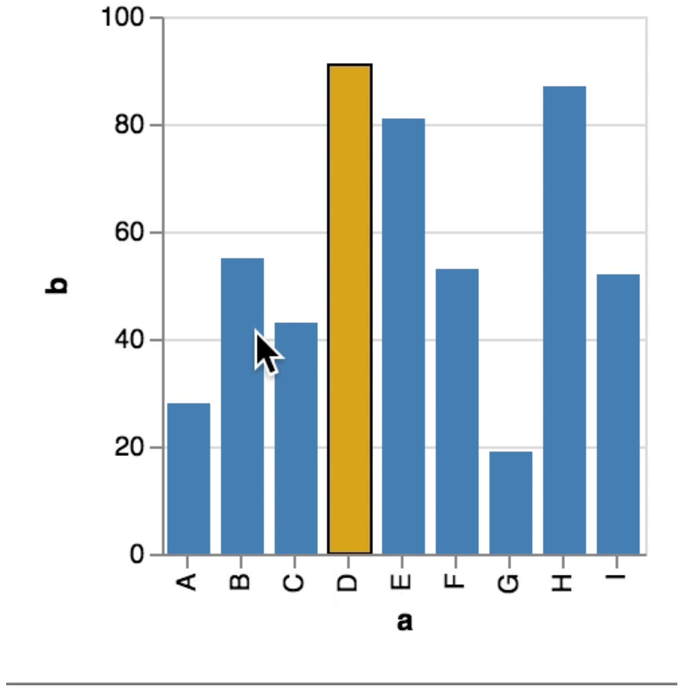
Point Selection

Select discrete data values.

- How many points are selected? 1, 2, 3, ...
- How are points selected? Mouse hover, click, tap, ...





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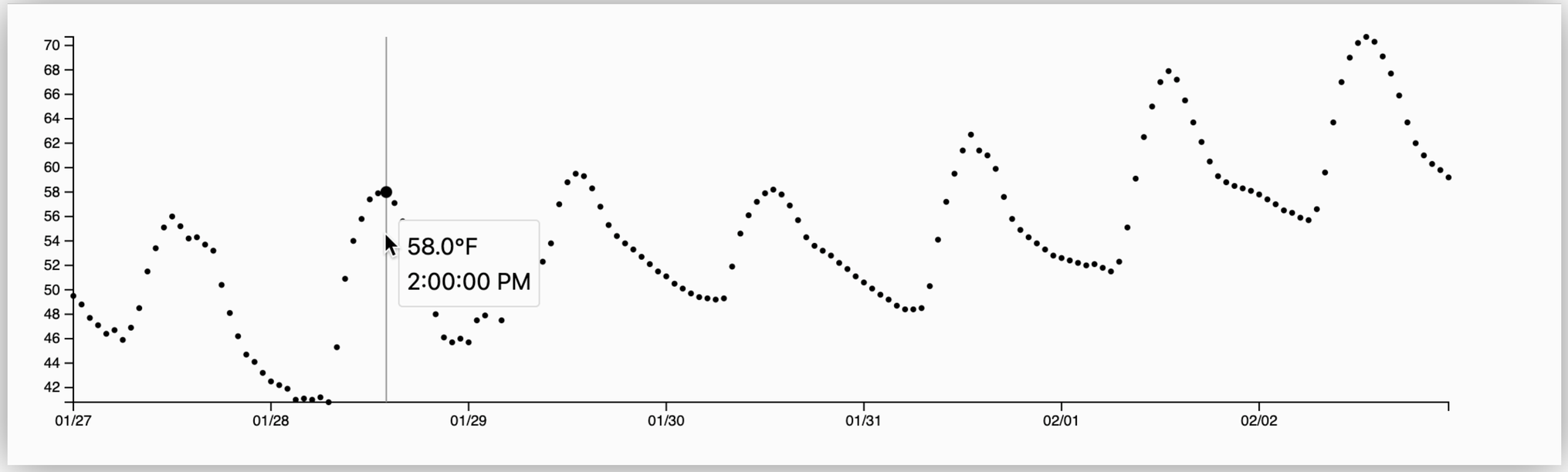
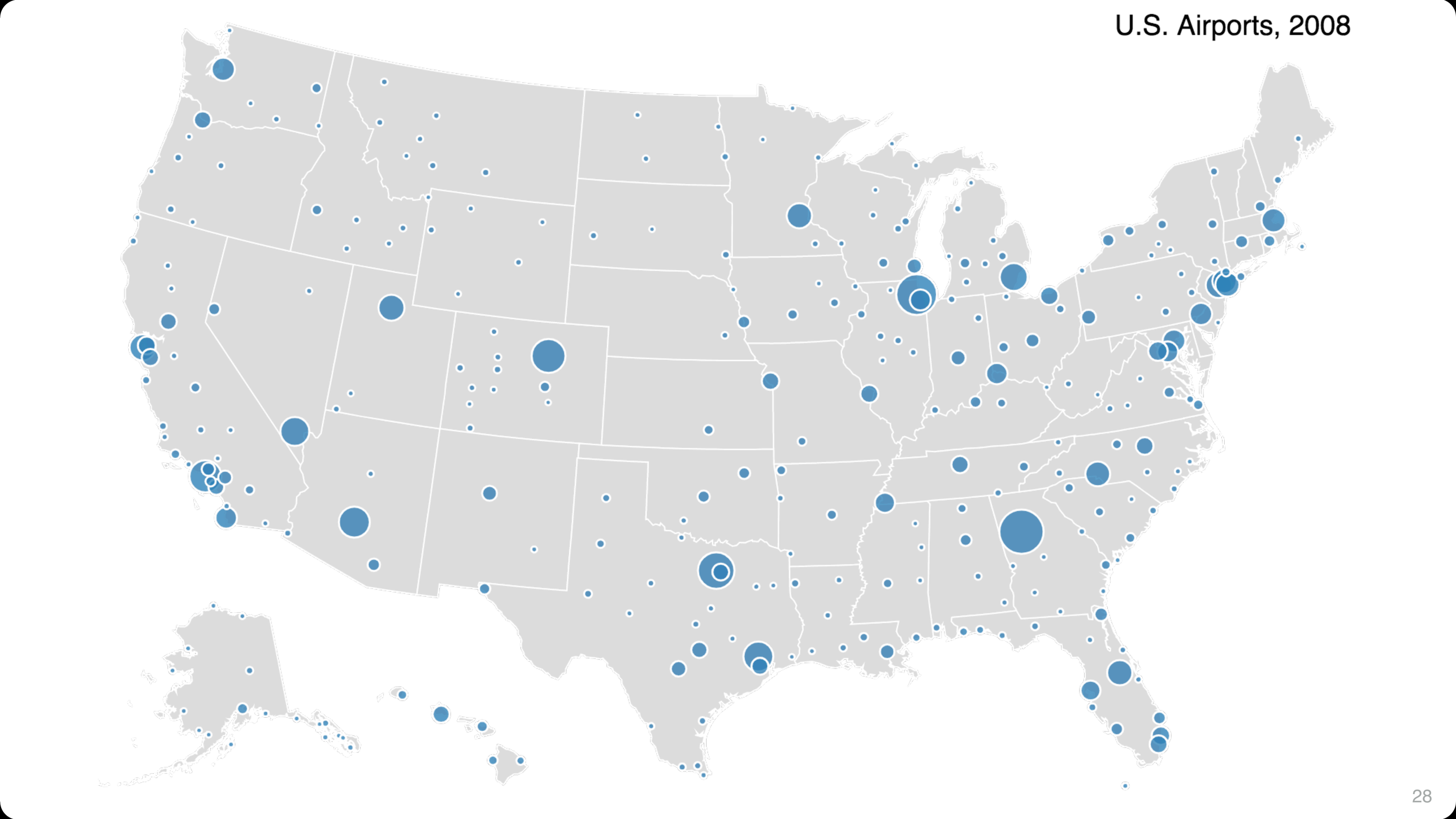
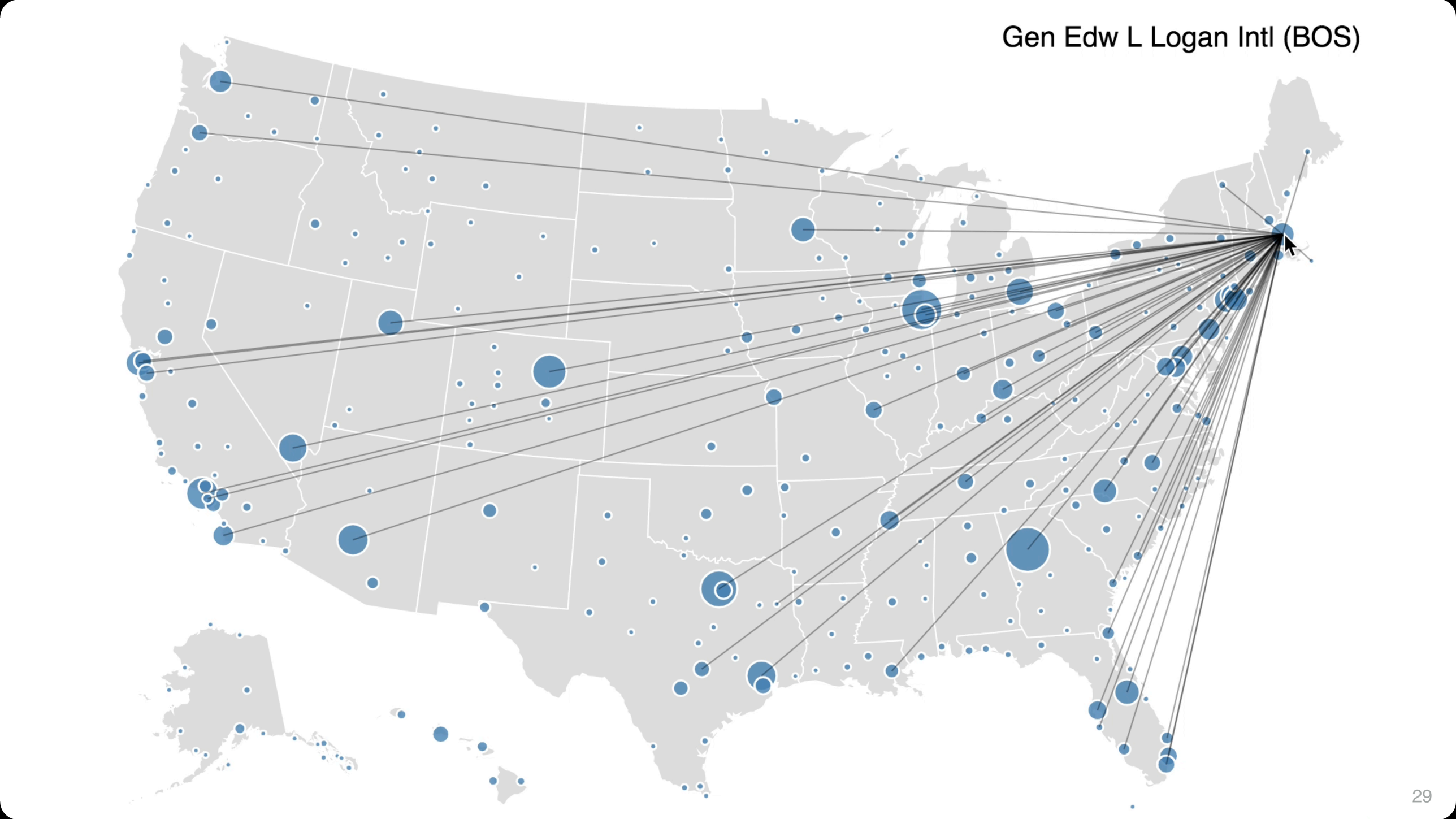
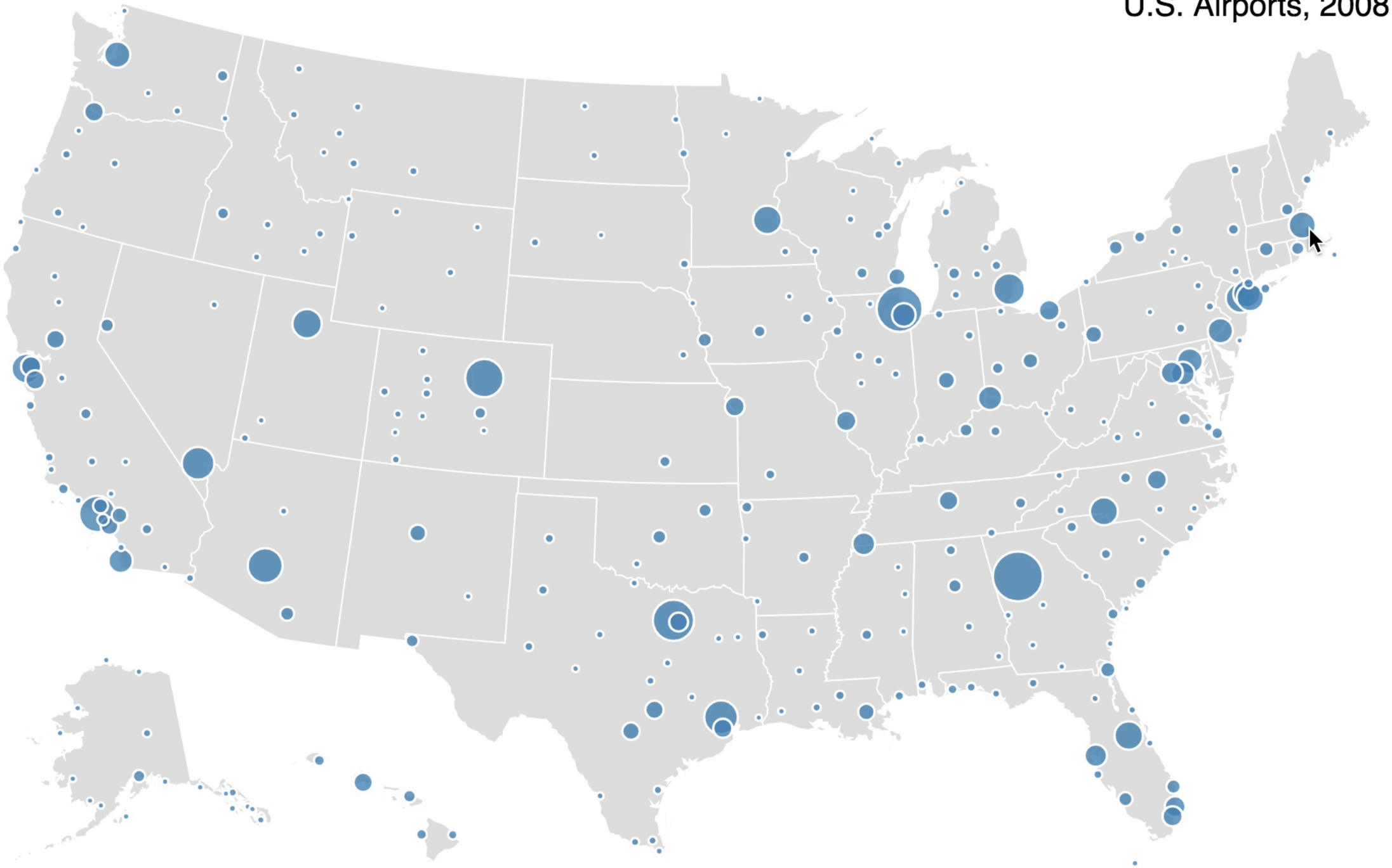



U.S. Airports, 2008


Gen Edw L Logan Intl (BOS)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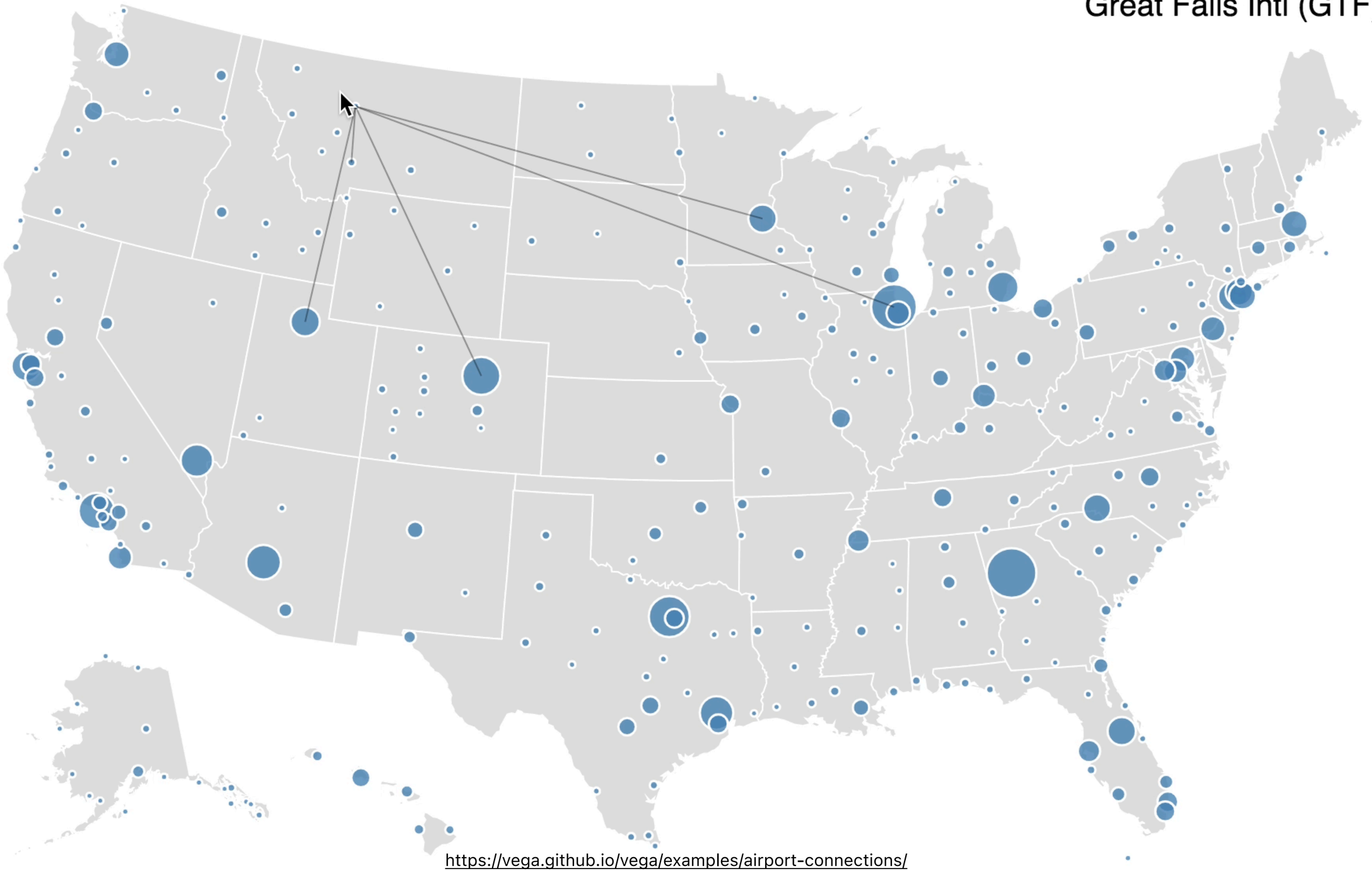
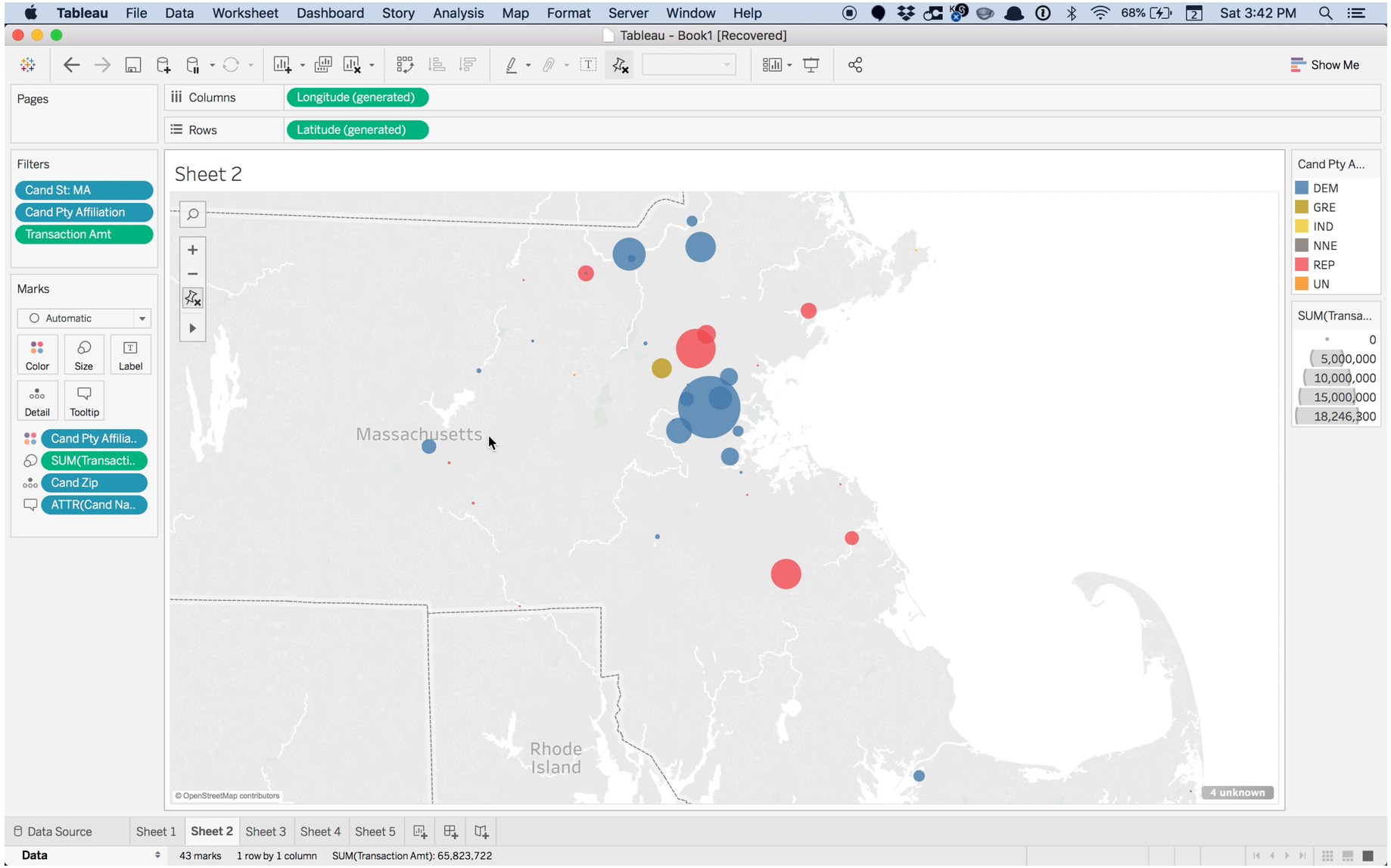


https://vega.github.io/vega/examples/airport-connections/

Region Selection



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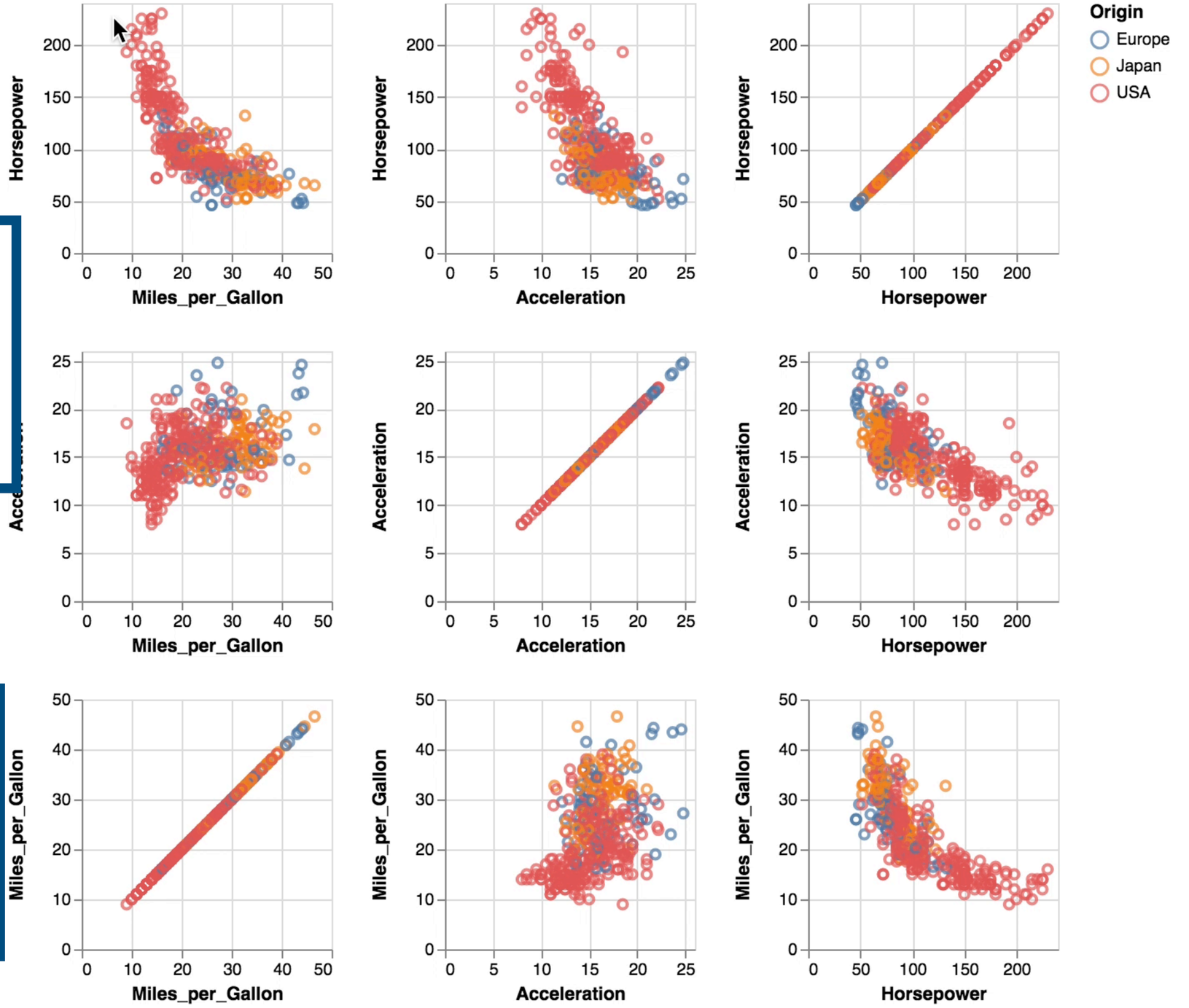
Connect

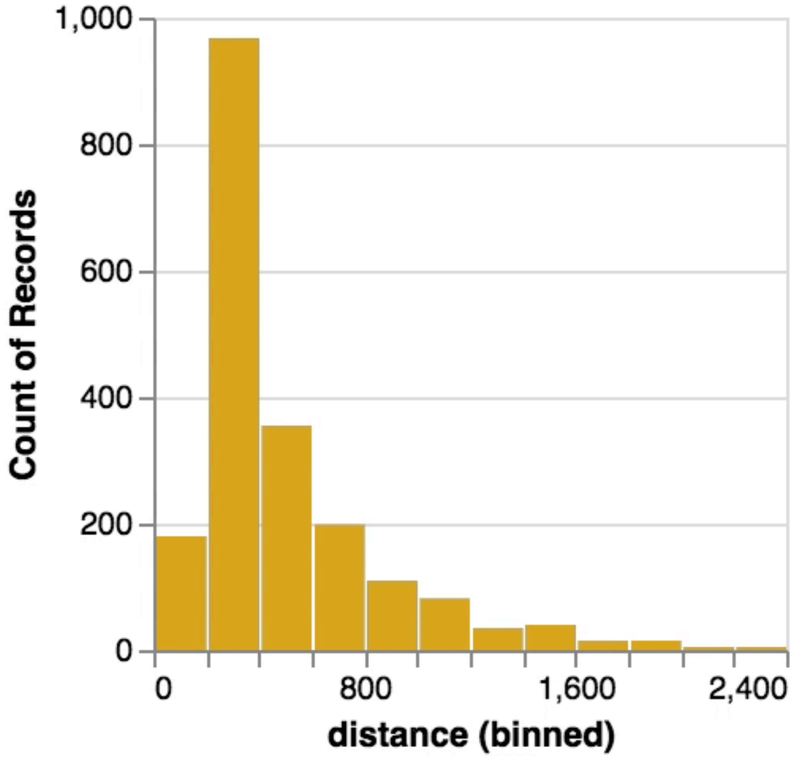
Brushing & linking: selection = "brush", selected data "linked" in other views.

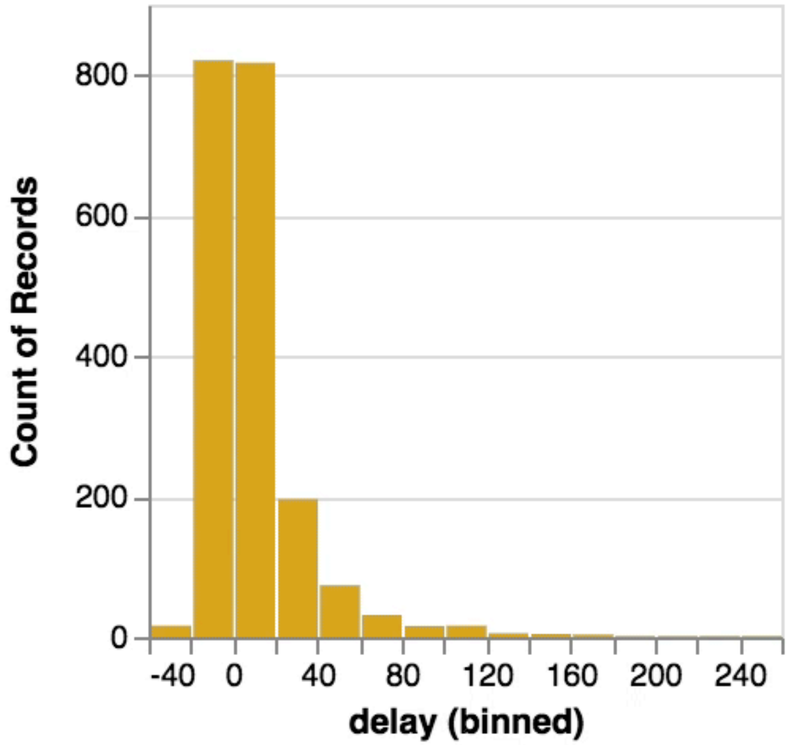
Link by tuple: explicitly identify and match the same data values across every view.

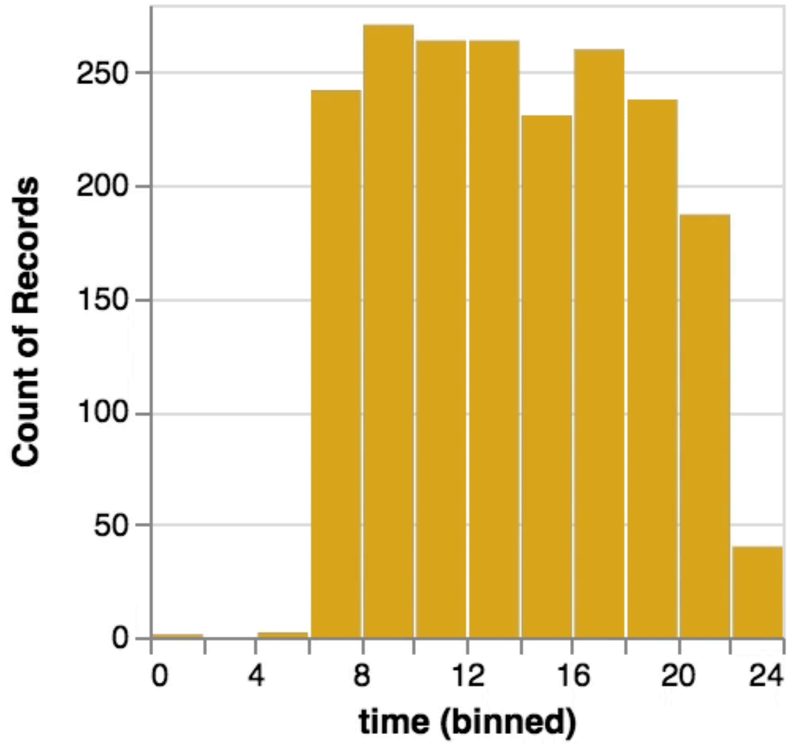


Connect

Link by query: matching range or values of fields.







Connect doesn't have to be just highlighting!

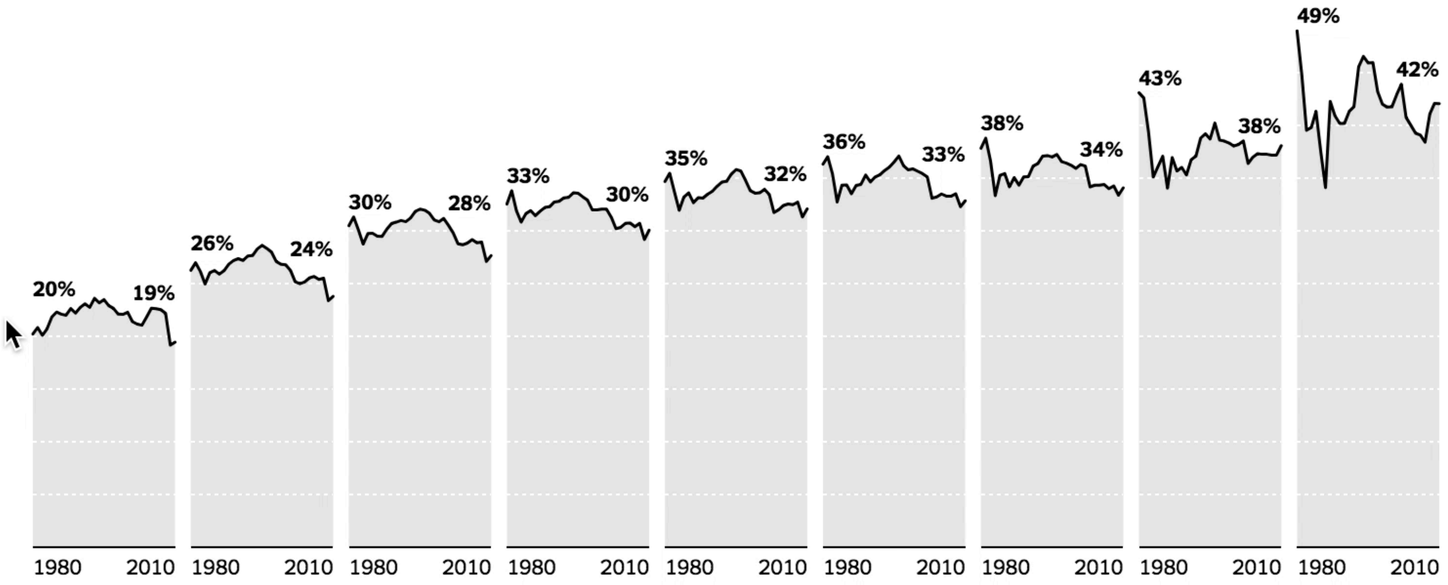
How the Tax Burden Has Changed

Most Americans paid less in taxes in 2010 than people with the same inflation-adjusted incomes paid in 1980, because of cuts in federal income taxes. At lower income levels, however, much of the savings was offset by increases in federal payroll taxes, state sales taxes and local property taxes. About half of households making less than $25,000 saved nothing at all. About the Data » | Related Article »

$0-25k | $25-50k | $50-75k | $75-100k | $100-125k | $125-150k | $150-200k | $200-350k | $350k+

Tax rates have fallen for most Americans, especially high earners.

Share of yearly income paid in federal, state and local taxes, by income bracket.



https://archive.nytimes.com/www.nytimes.com/interactive/2012/11/30/us/tax-burden.html

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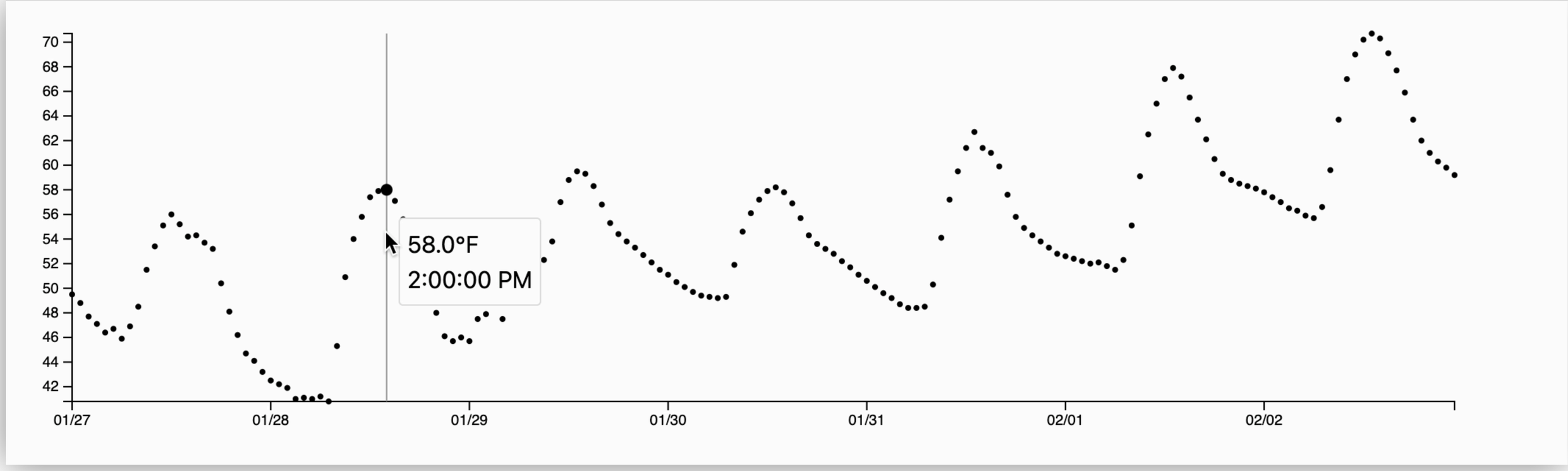
Elaborate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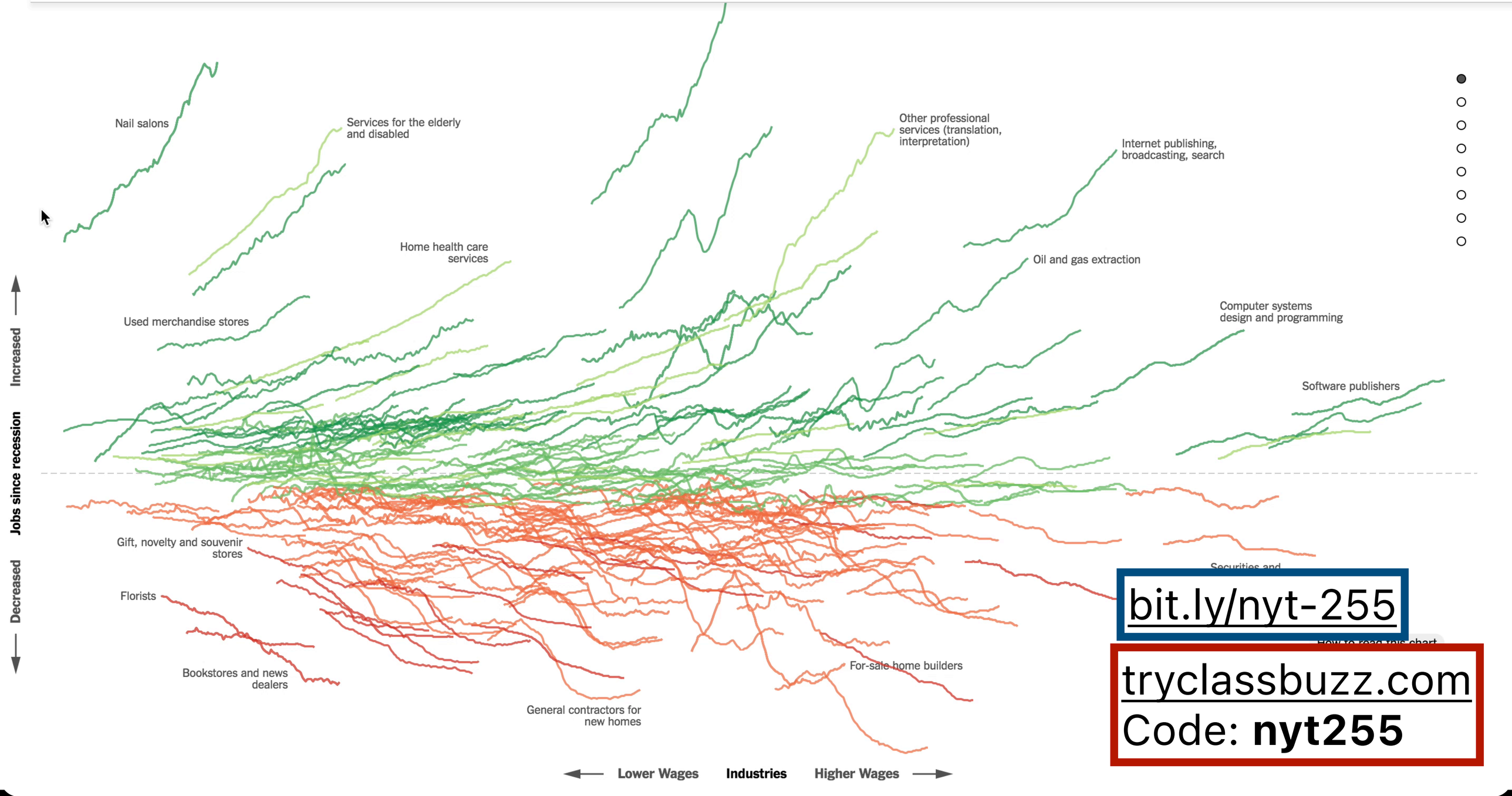
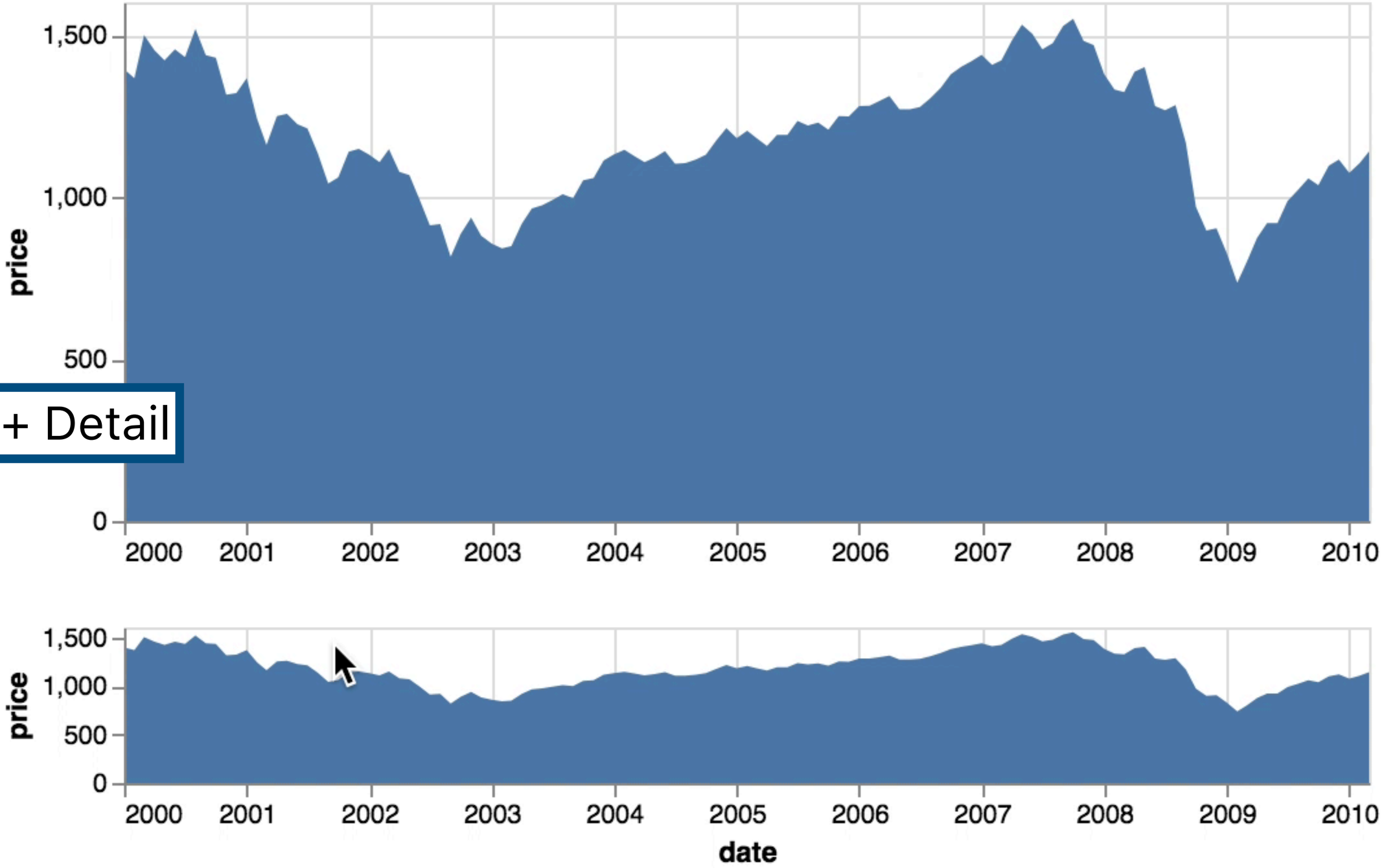


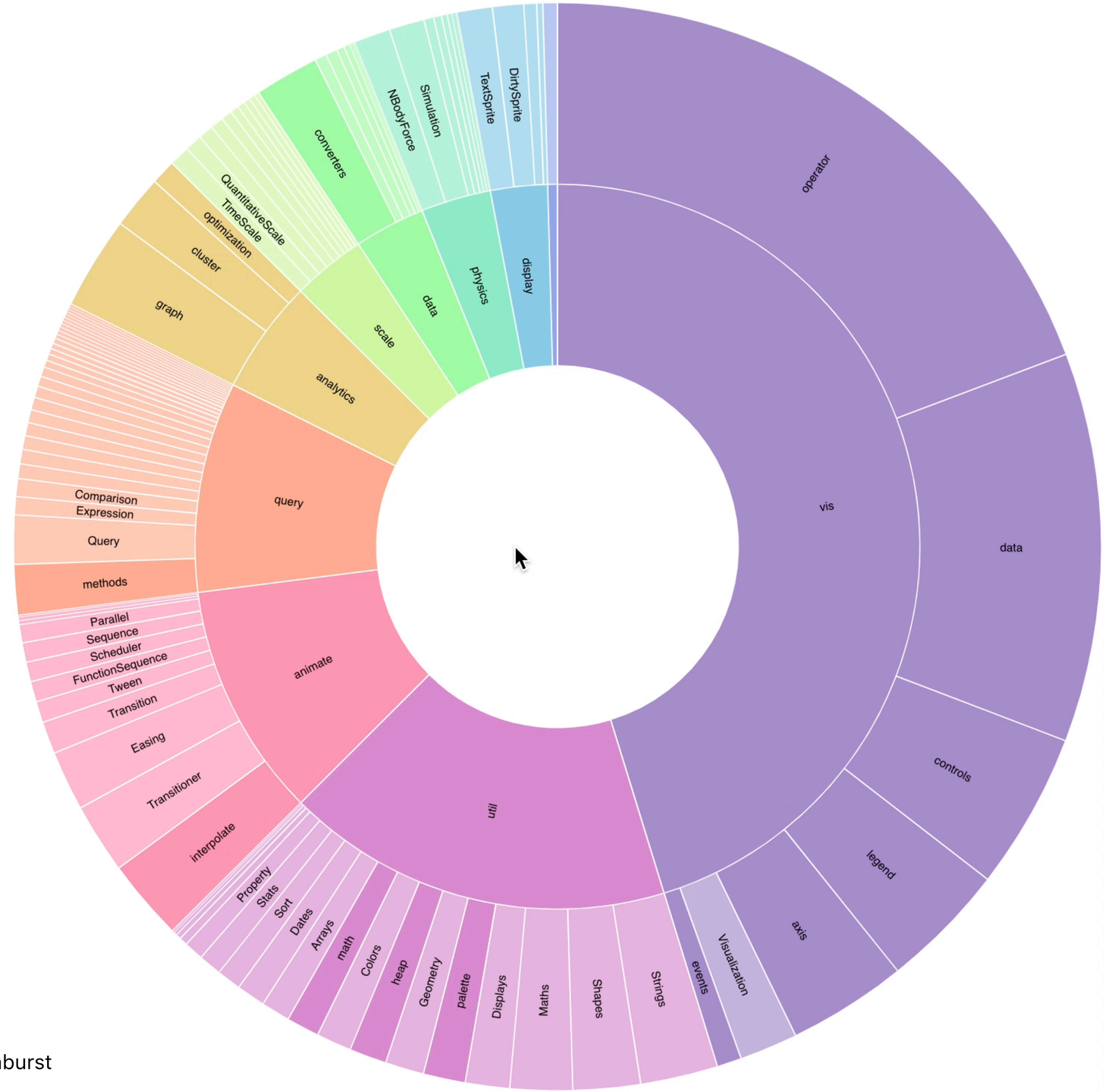
bit.ly/nyt-255

tryclassbuzz.com
Code: **nyt255**

Overview + Detail



https://vega.github.io/vega-lite/examples/interactive_overview_detail.html



https://observablehq.com/@d3/zoomable-sunburst

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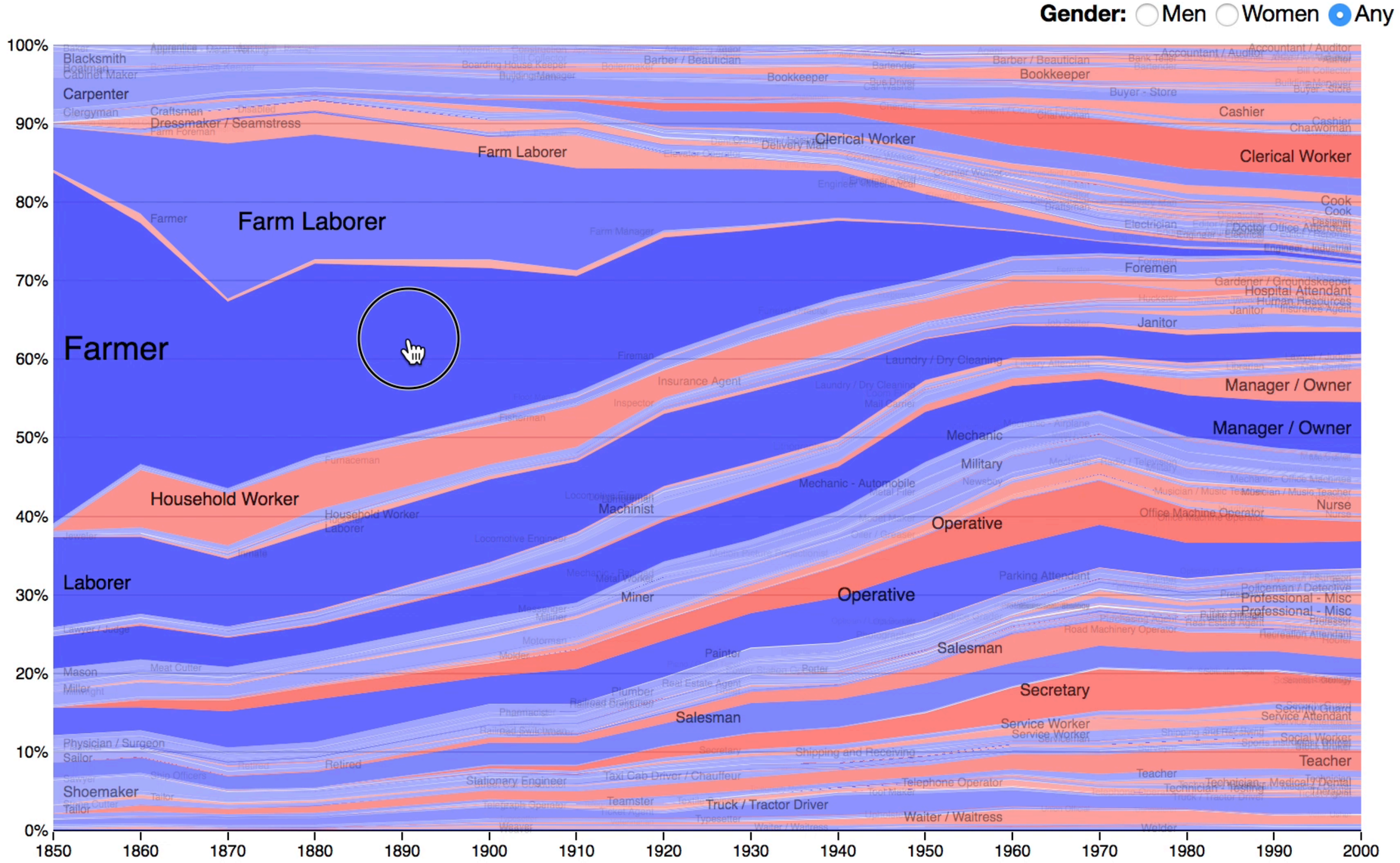
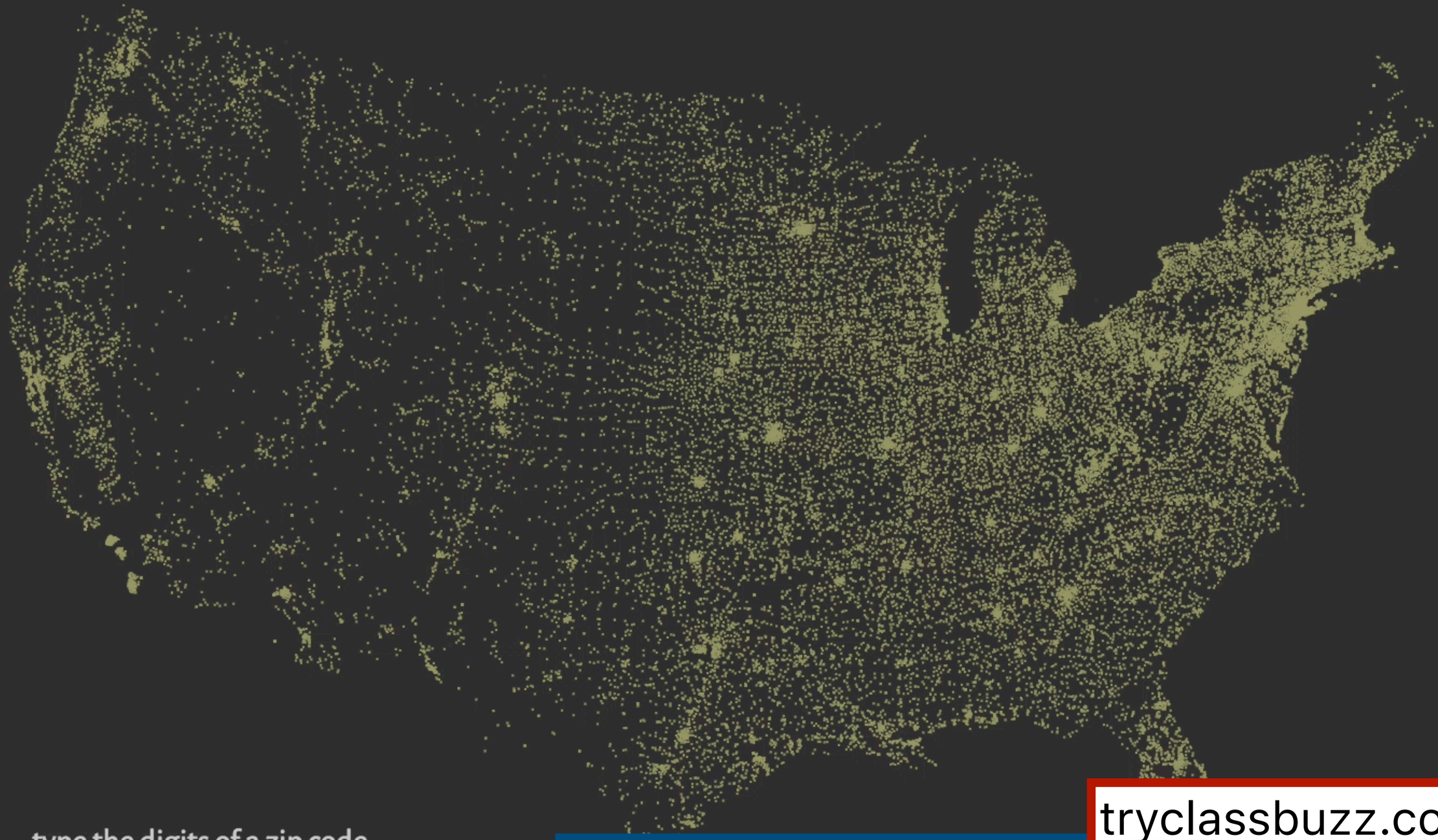
Job Voyager



https://mbostock.github.io/protovis/ex/jobs.html



ZioDecode. Ben Fry, 1999–2014.

benfry.com/zipdecode/

tryclassbuzz.com
Code: **zip**

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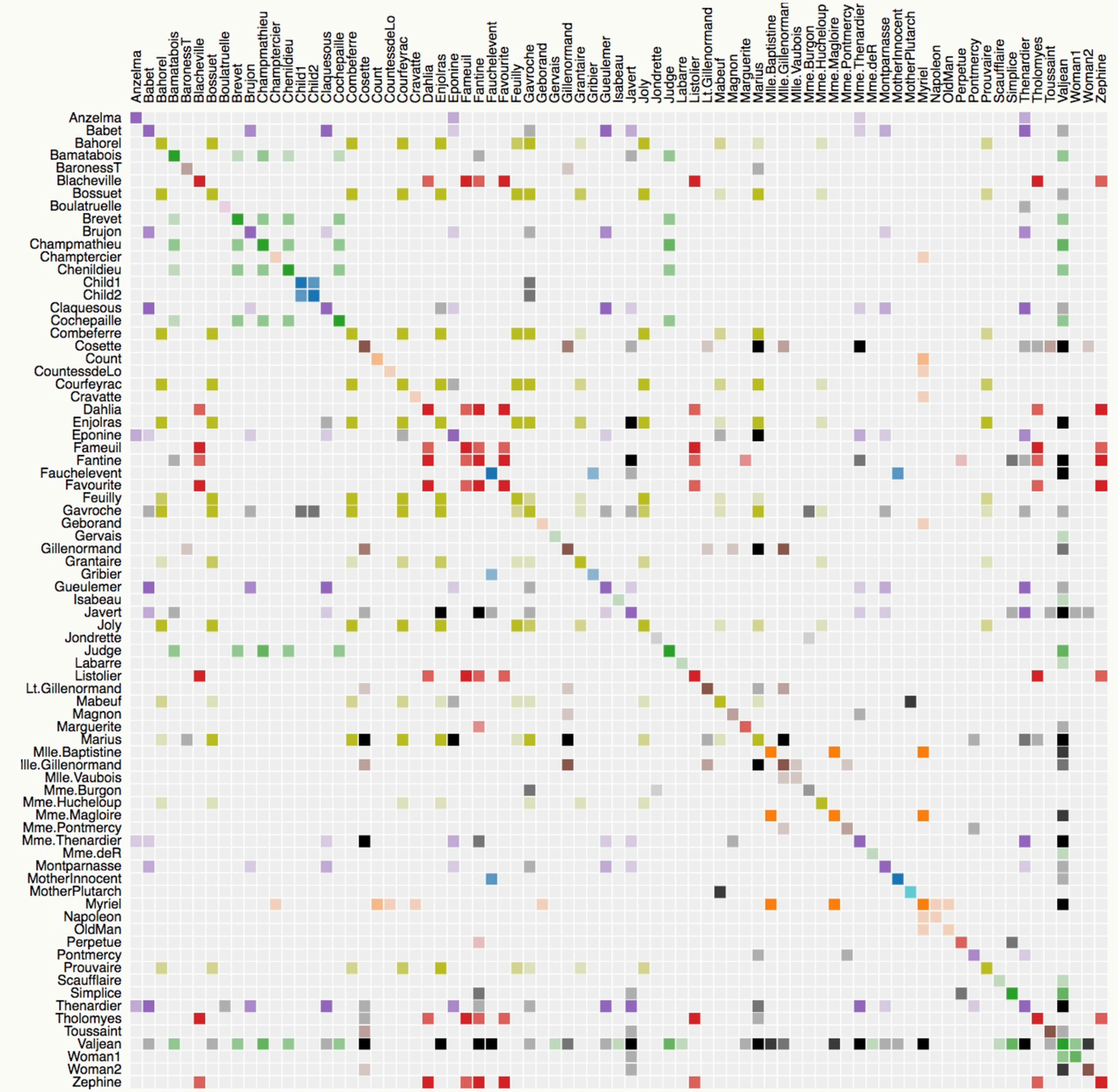
Reconfigure



Order: by Name

This matrix diagram visualizes character co-occurrences in Victor Hugo's *Les Misérables*.

Each colored cell represents two characters that appeared in the same chapter; darker cells indicate characters that co-occurred more frequently.

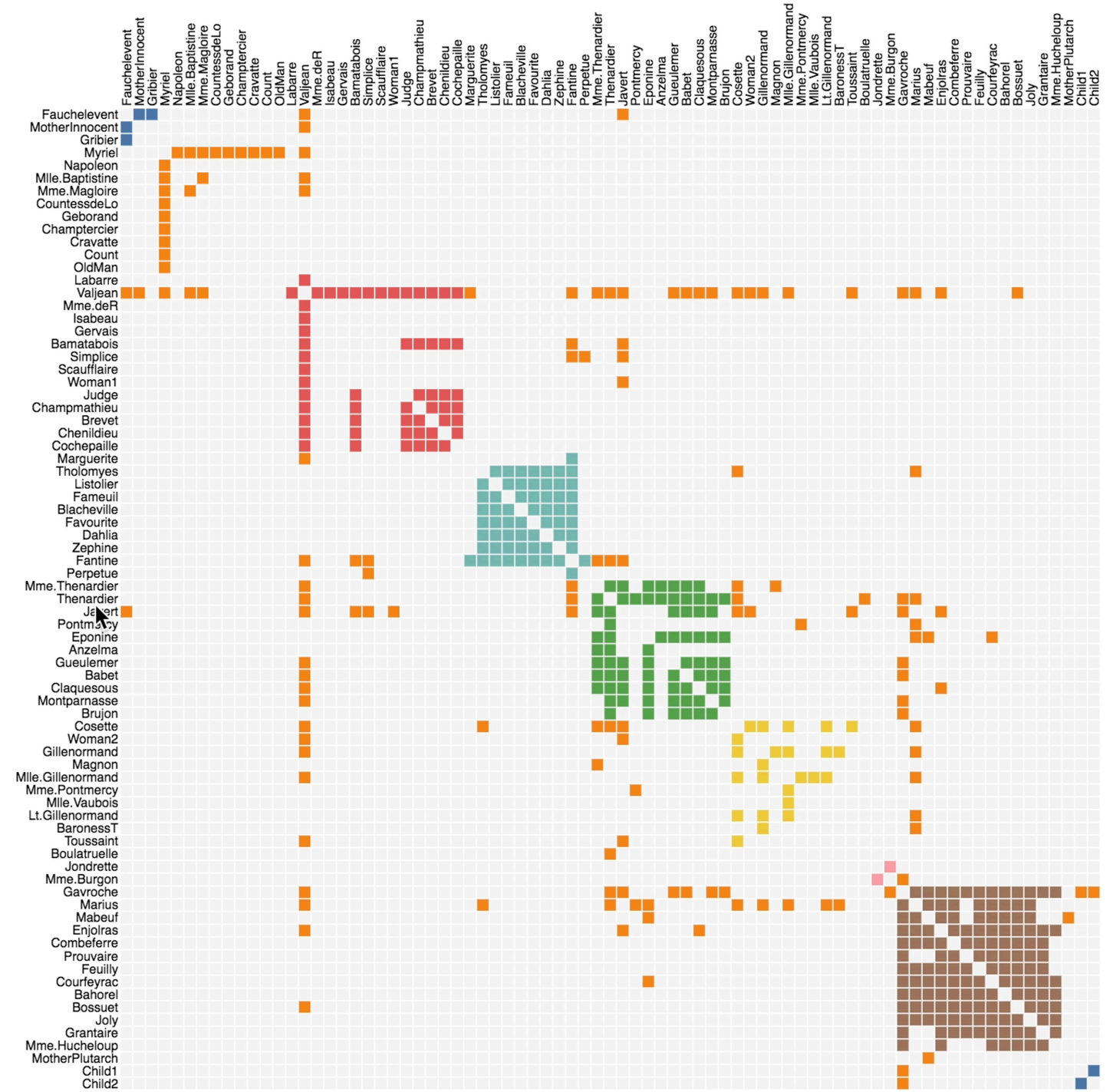
Use the drop-down menu to reorder the matrix and explore the data.

Built with d3.js.

Source: The Stanford GraphBase.

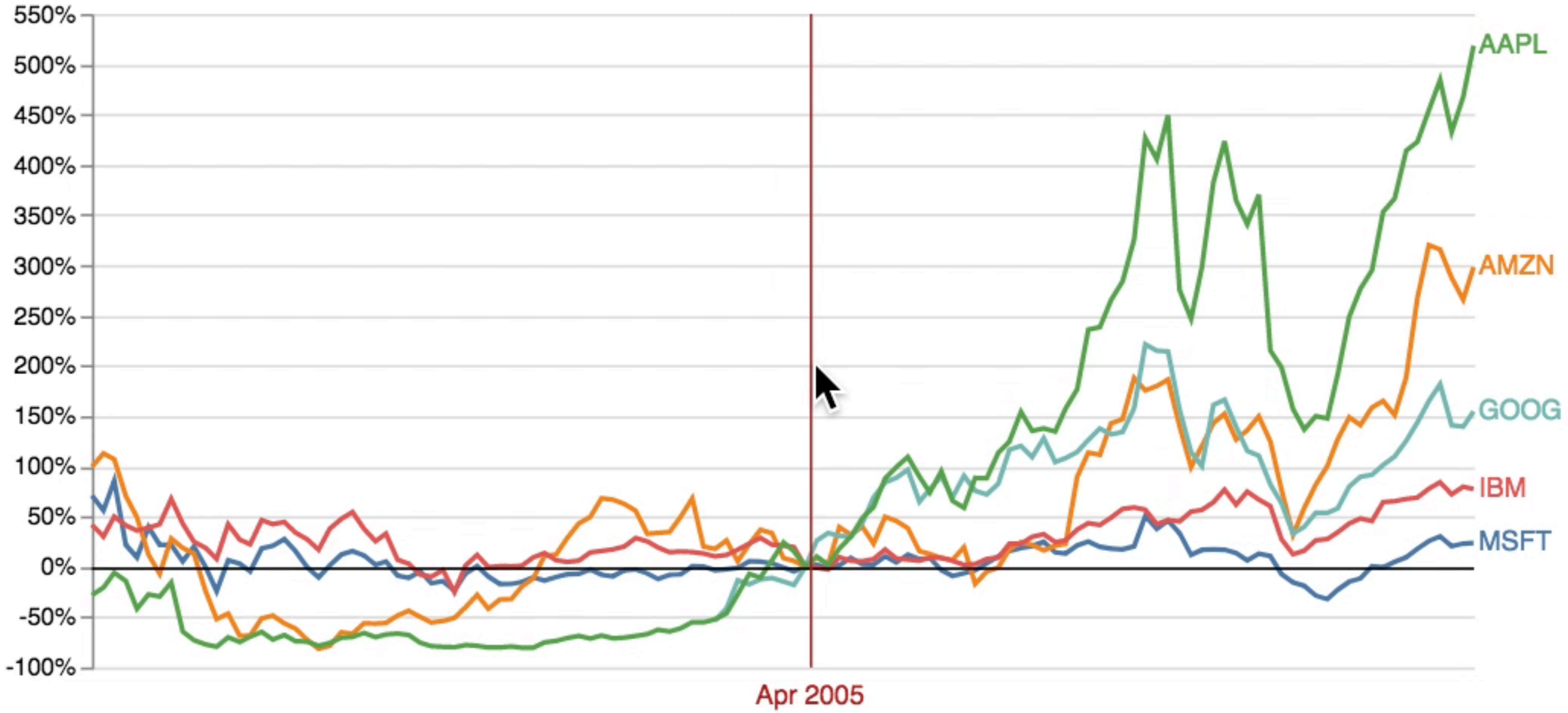
https://bost.ocks.org/mike/miserables/

Reconfigure



https://bost.ocks.org/mike/miserables/

Reconfigure



https://vega.github.io/vega/examples/stock-index-chart/

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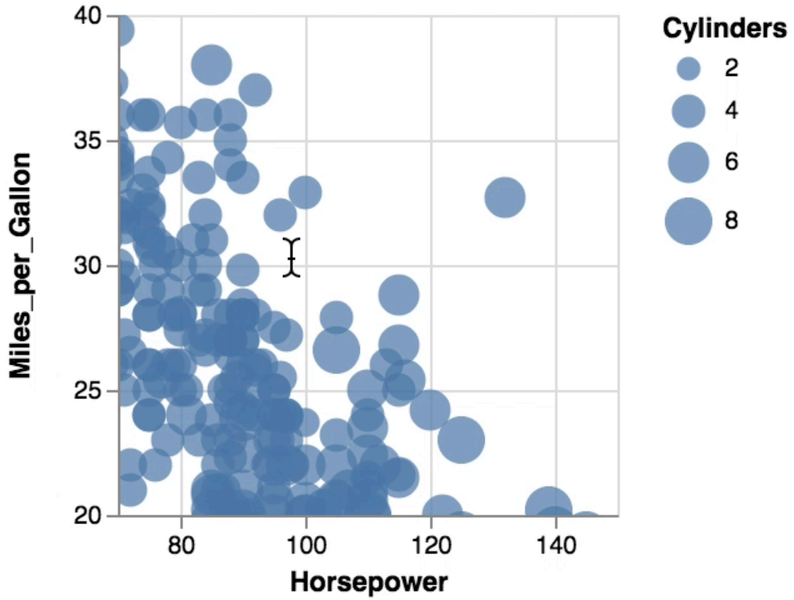
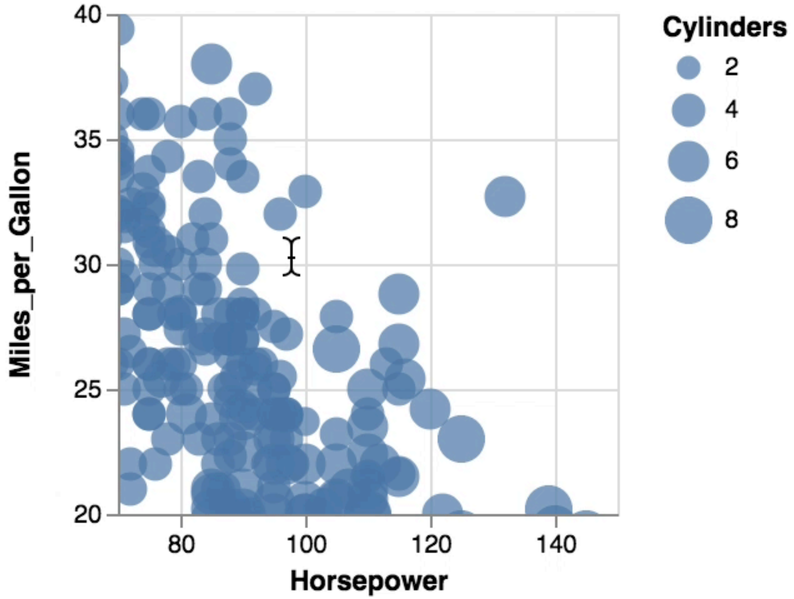
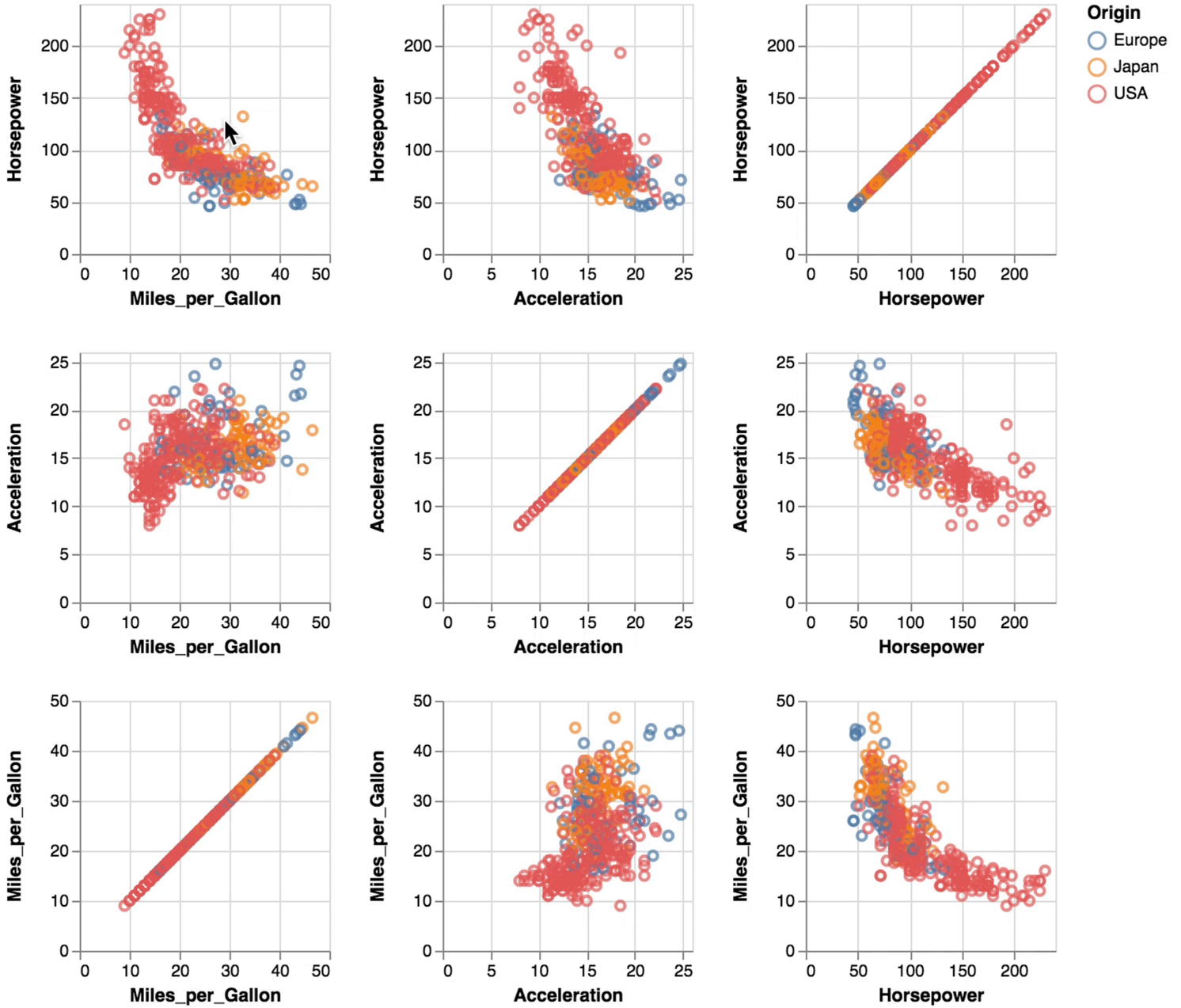
Explore



https://vega.github.io/vega-lite/examples/selection_translate_scatterplot_drag.html

Explore





https://vega.github.io/vega-lite/examples/selection_translate_scatterplot_drag.html

https://vega.github.io/vega-lite/examples/interactive_splom.html

Explore

Geometric zoom: transforms the physical view (i.e., objects get larger as they get "closer").

https://bl.ocks.org/mbostock/3680999

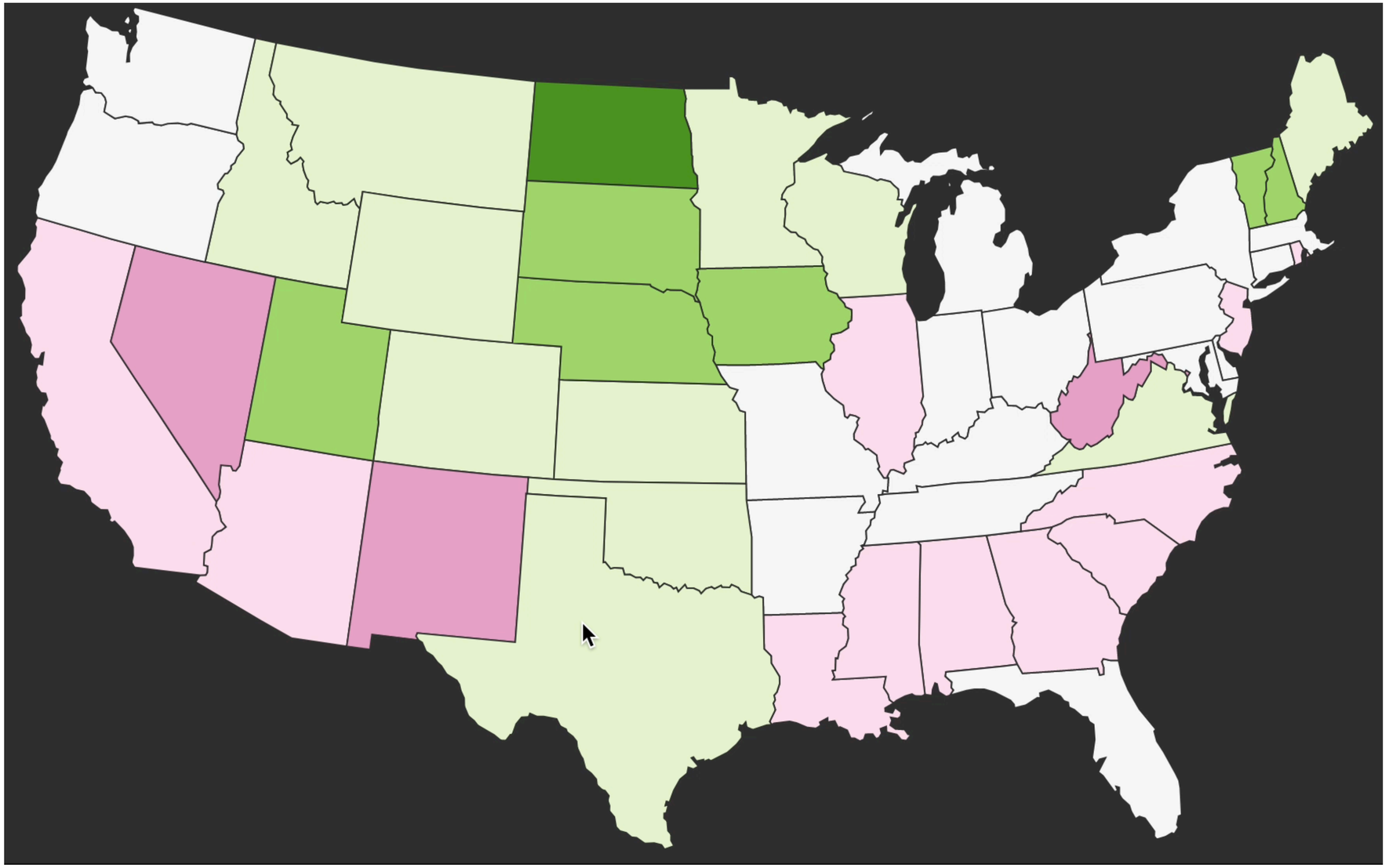
Explore

Semantic zoom: transforms the data space (i.e., objects stay the same size, but get further apart).

ɔostock/3680957

Explore

Semantic zoom: transforms the data space (i.e., objects stay the same size, but get further apart).



https://bl.ocks.org/cmgiven/d39ec773c4f063a463137748097ff52f

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See interactive systems like Tableau / Voyager

Encode	show me a different visual representation.

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Filter	show me more or less detail.
Reconfigure	show me a different arrangement.
Explore	show me som
Encode	show me a dif

Use interaction to help audience see something new, not just for visual eye candy!

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