

Interaction

DSC 106: Data Visualization

Sam Lau

UC San Diego

Announcements

Lab 6 due today

Project 3 due Tuesday next week

Project 2 peer grading out, due Tuesday next week

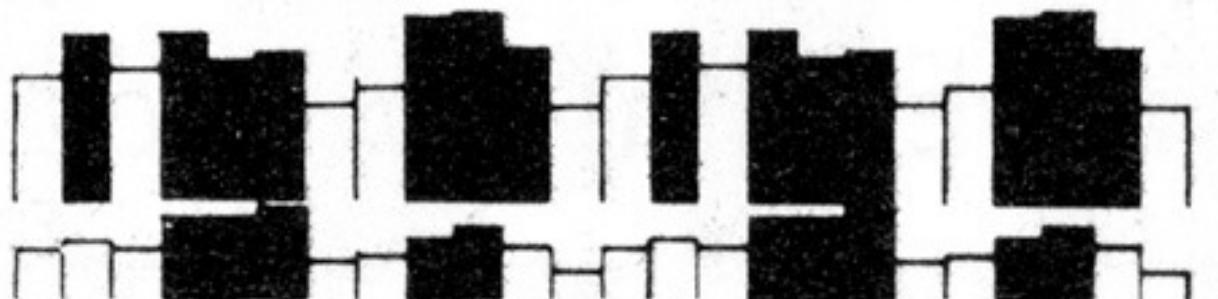
FAQs:

- 1. What about the last step for the D3 demo from last lecture?** Video is up on Piazza now.
- 2. What if I submitted Lab 6 video before we announced the 1-min requirement?** No need to resubmit, but future lab videos should be 1-min or less!

Example: Bertin's Hotel Data

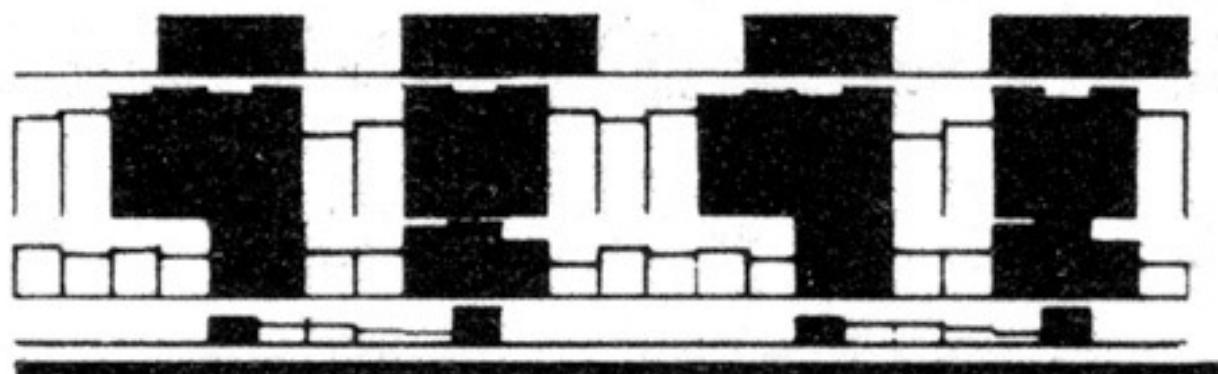
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69	70	77	71	37	36	39	39	55	60	68	72	2	% —" LOCAL						
7	6	3	6	23	14	19	14	9	6	8	8	3	% —" U.S.A.						
0	0	0	0	8	6	6	4	2	12	0	0	4	% —" SOUTH AMERICA						
20	15	14	15	23	27	22	30	27	19	19	17	5	% —" EUROPE						
1	0	0	8	6	4	6	4	2	1	0	1	6	% —" M.EAST, 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	20	19	22	16	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 CONVENTIONS						
		X	X	X			X	X	X	X	X	20							

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19 % OCCUPANCY

18 LENGTH OF STAY



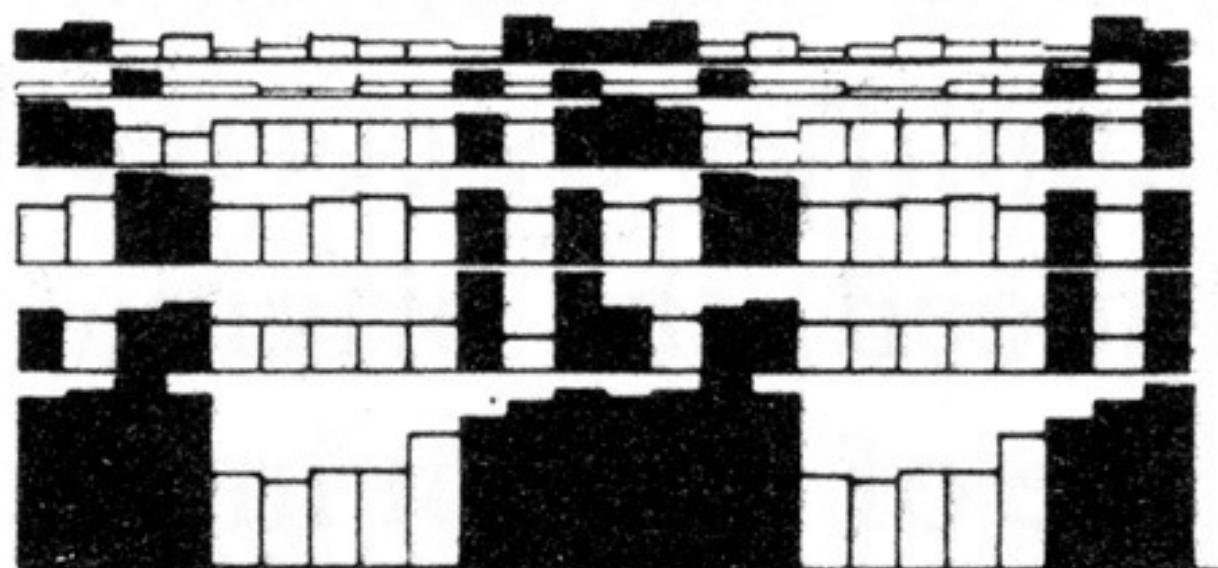
20 CONVENTIONS

• BUSINESSMEN

11 AGENCY RESERVATIONS

4 SOUTH AMERICA

ACTIVE AND
SLOW PERIODS



12 AIR CREWS

13 CLIENTS UNDER 20 YEARS

16 CLIENTS MORE THAN 55 YEARS

14 CLIENTS FROM 20-35 YEARS

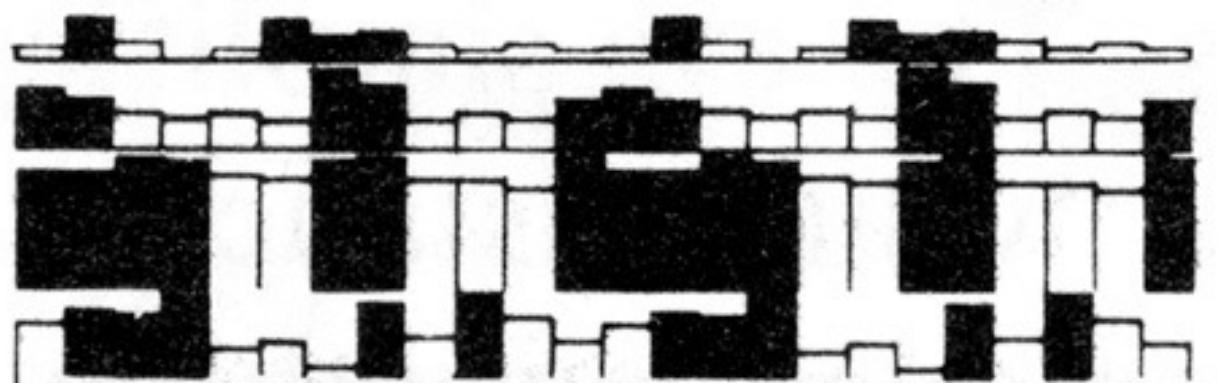
1 FEMALE CLIENTELE

2 LOCAL CLIENTELE

DISCOVERY FACTORS

RECOVERY FACTORS

WINTER

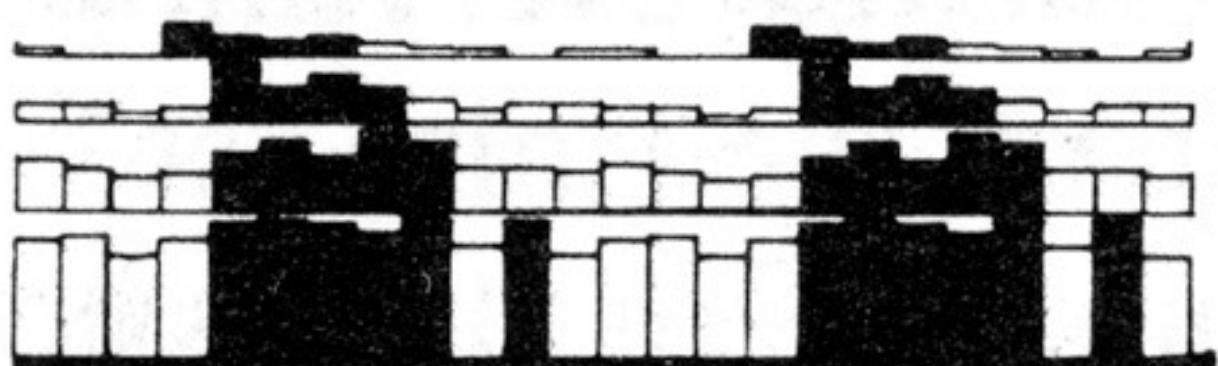


7 ASIA

9 TOURISTS

10 DIRECT RESERVATION

17 PRICE OF ROOMS



• MIDDLE EAST, AFRICA

3 U. S. A.

5 EUROPE

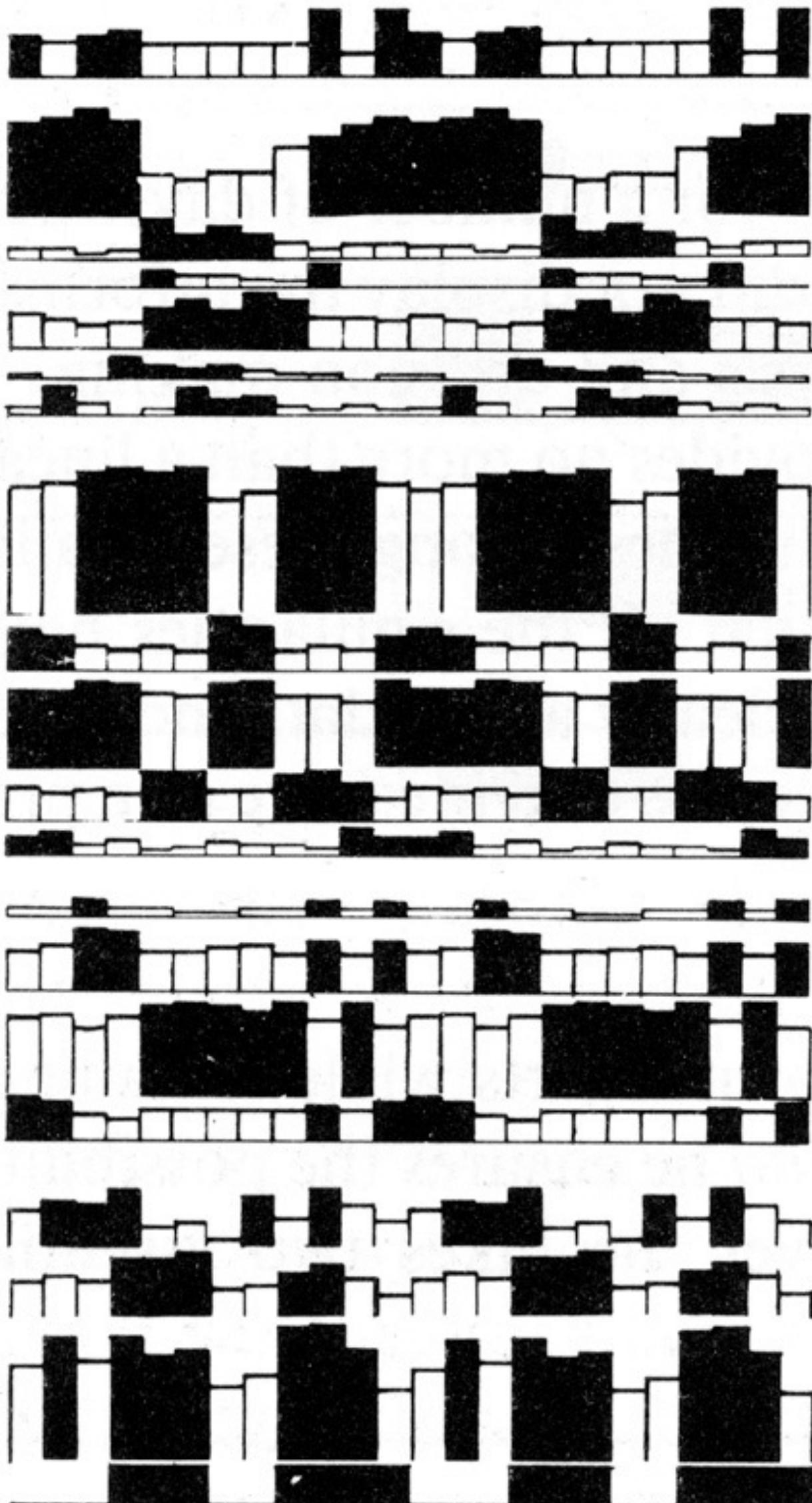
15 CLIENTS FROM 35-55 YEARS

WINTER-SUMMER

SUMMER

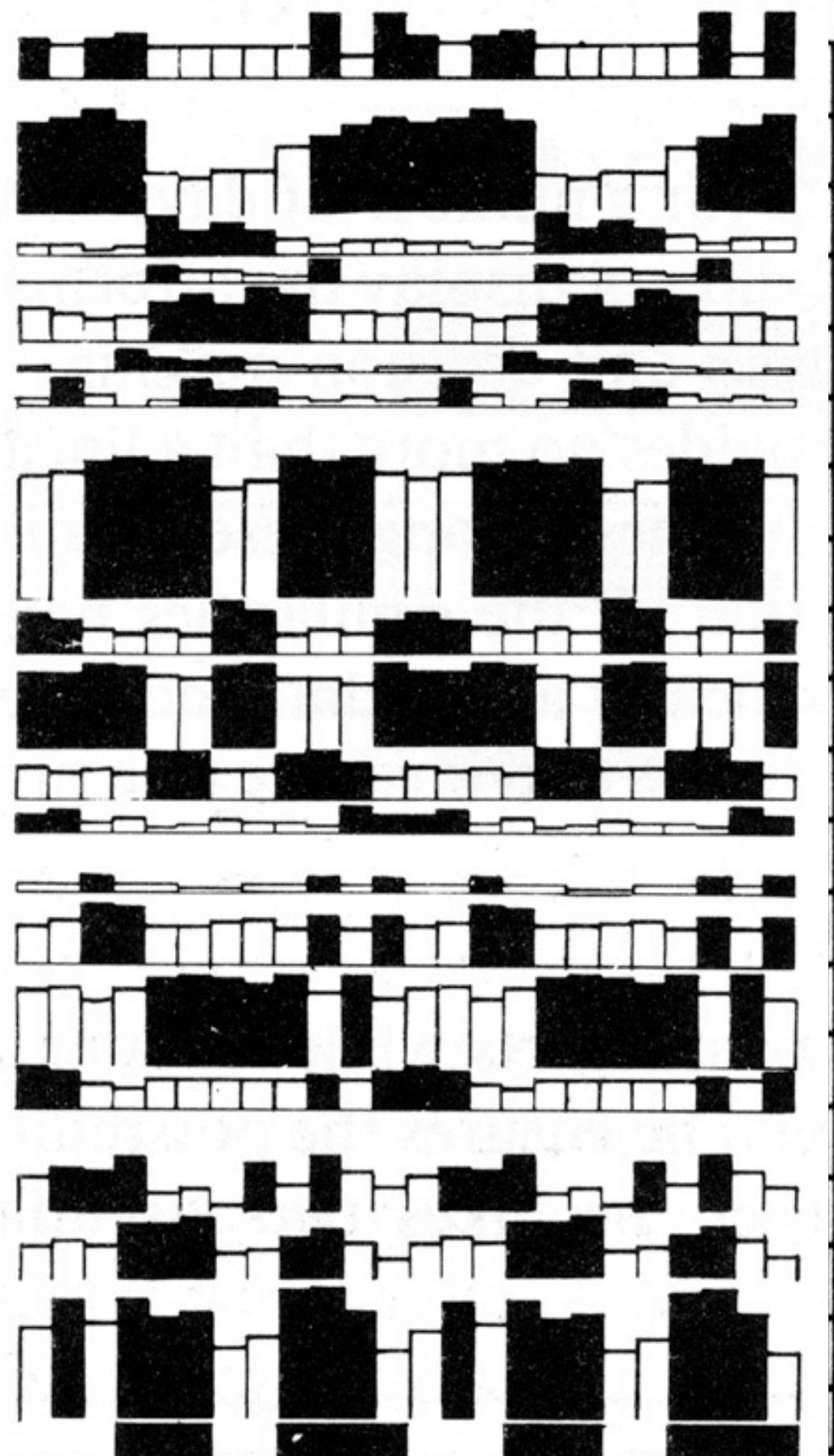
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67	82	70	83	74	77	56	62	90	92	78	55	19	% OCCUPANCY CONVENTIONS						
		X	X	X			X	X	X	X	X	20							

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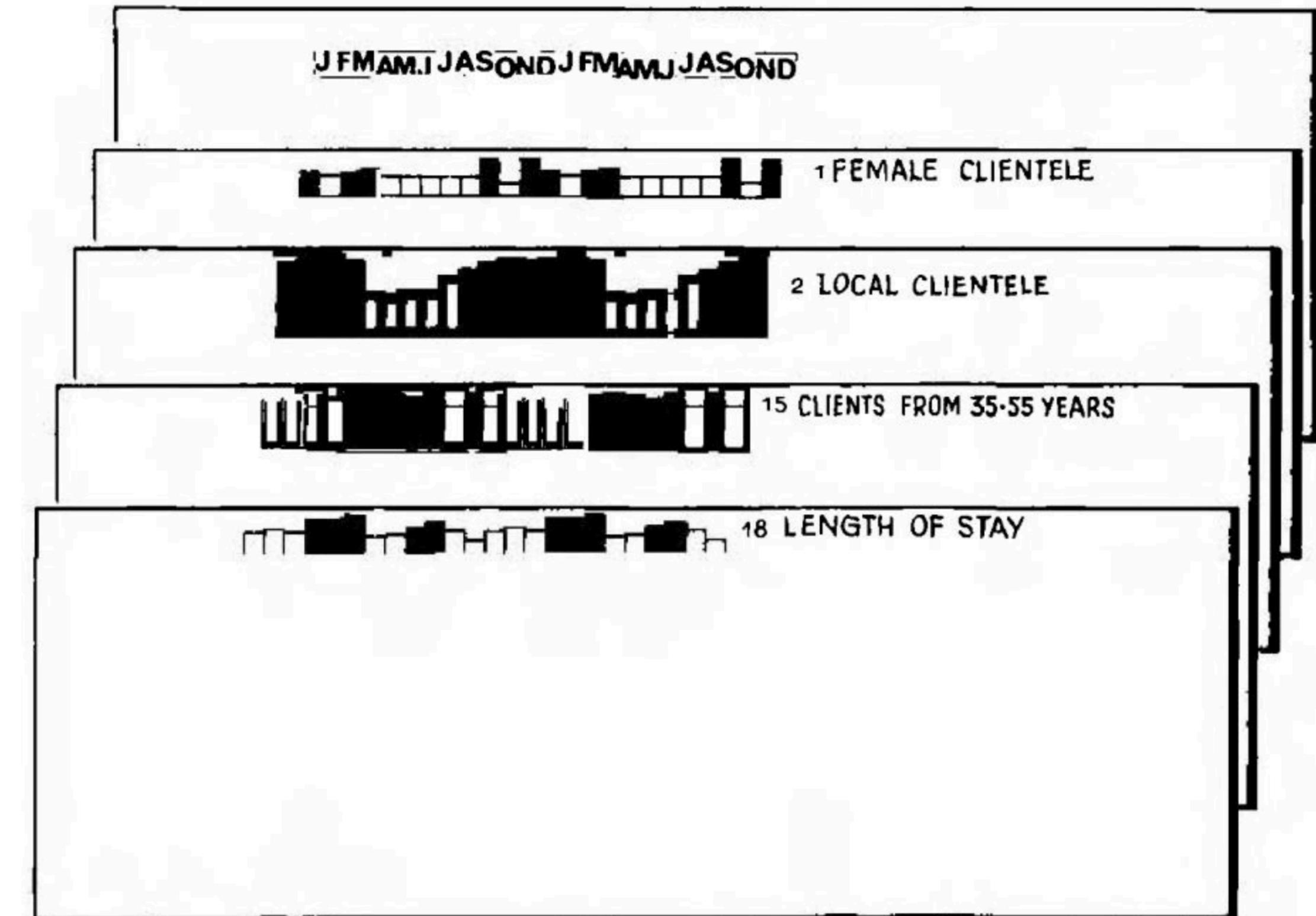


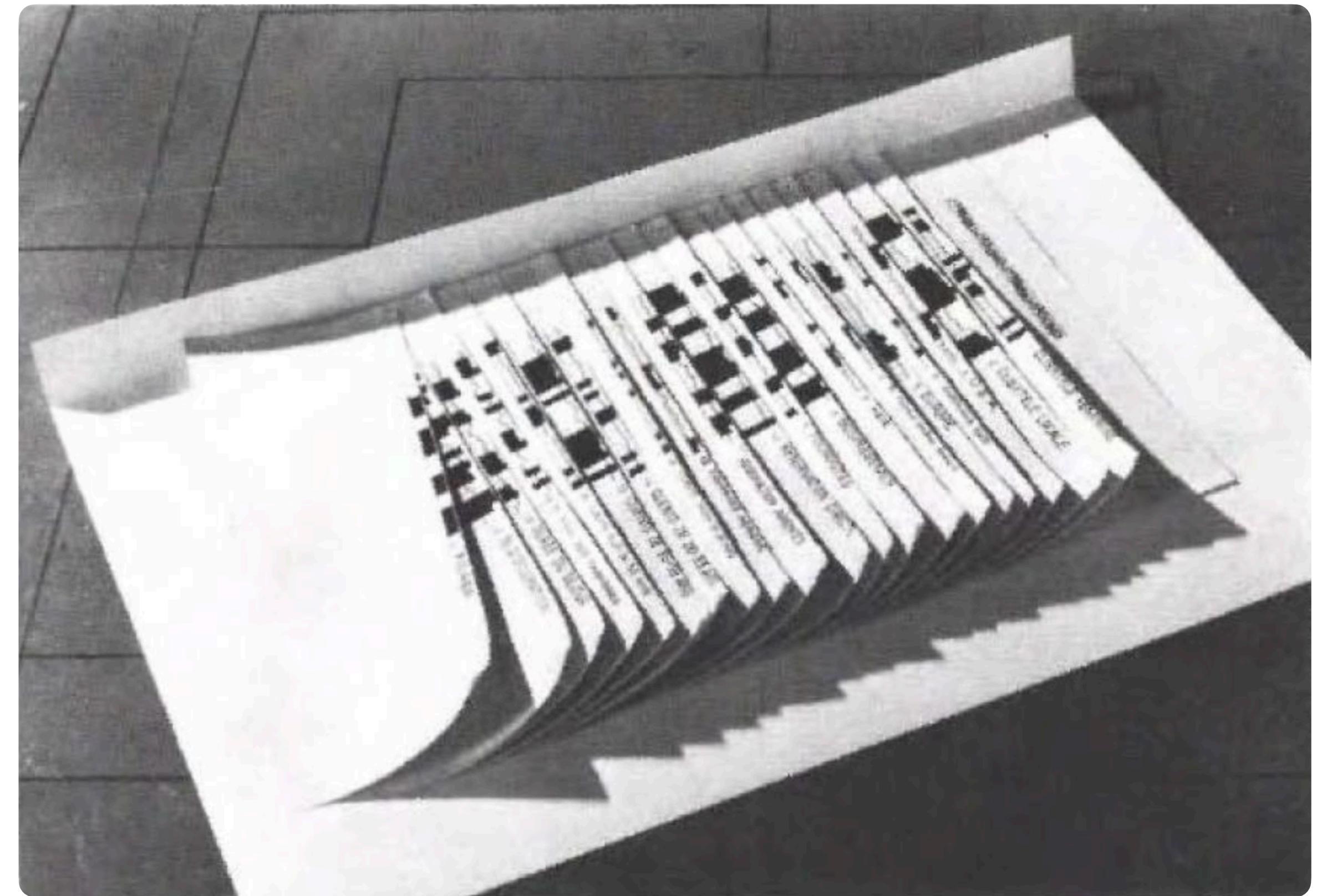
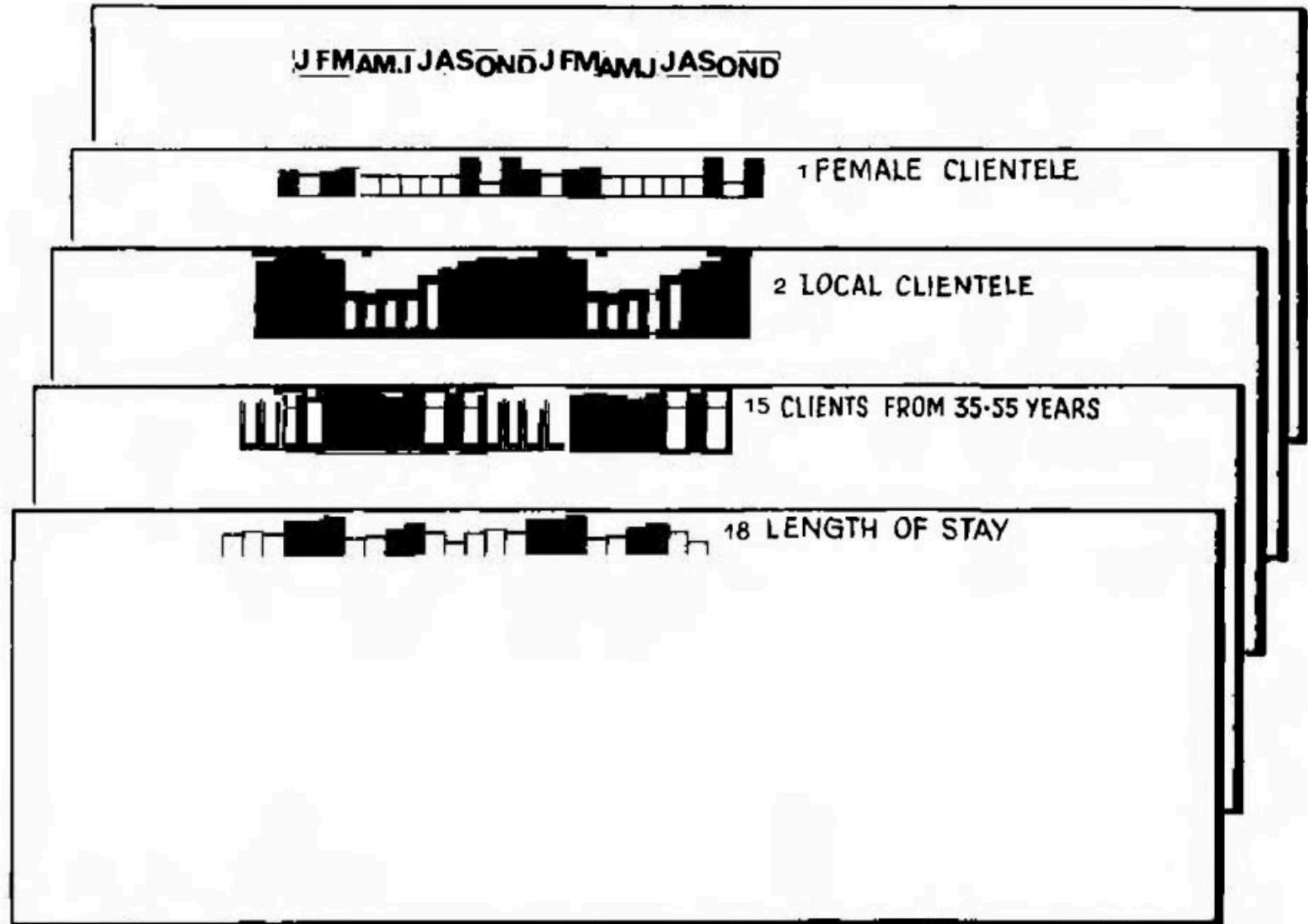
- | | |
|----|--------------------------|
| 1 | % CLIENTELE FEMALE |
| 2 | % —" LOCAL |
| 3 | % —" U.S.A. |
| 4 | % —" SOUTH AMERICA |
| 5 | % —" EUROPE |
| 6 | % —" M.EAST, AFRICA |
| 7 | % —" ASIA |
| 8 | % BUSINESSMEN |
| 9 | % TOURISTS |
| 10 | % DIRECT RESERVATIONS |
| 11 | % AGENCY —" —" |
| 12 | % AIR CREWS |
| 13 | % CLIENTS UNDER 20 YEARS |
| 14 | % —" 20-35 —" —" |
| 15 | % —" 35-55 —" —" |
| 16 | % —" MORE THAN 55 —" —" |
| 17 | PRICE OF ROOMS |
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| 20 | |

J F M A M J J A S O N D J F M A M J J A S O N D

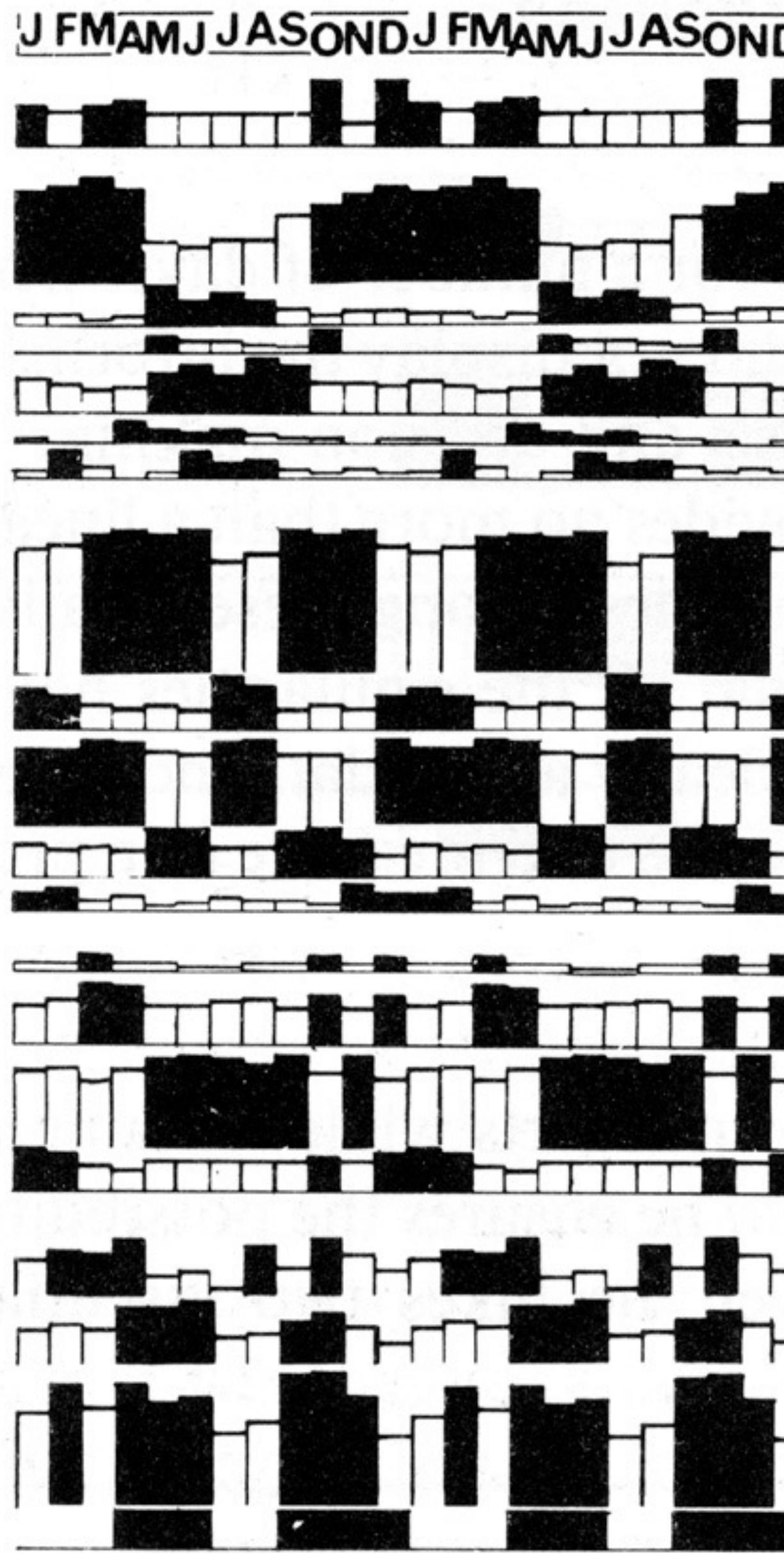


Category	January	February	March	April	May	June	July	August	September	October	November	December
1 % CLIENTELE FEMALE	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
2 % --" LOCAL	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
3 % --" U.S.A.	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
4 % --" SOUTH AMERICA	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
5 % --" EUROPE	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
6 % --" M.EAST, AFRICA	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
7 % --" ASIA	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
8 % BUSINESSMEN	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
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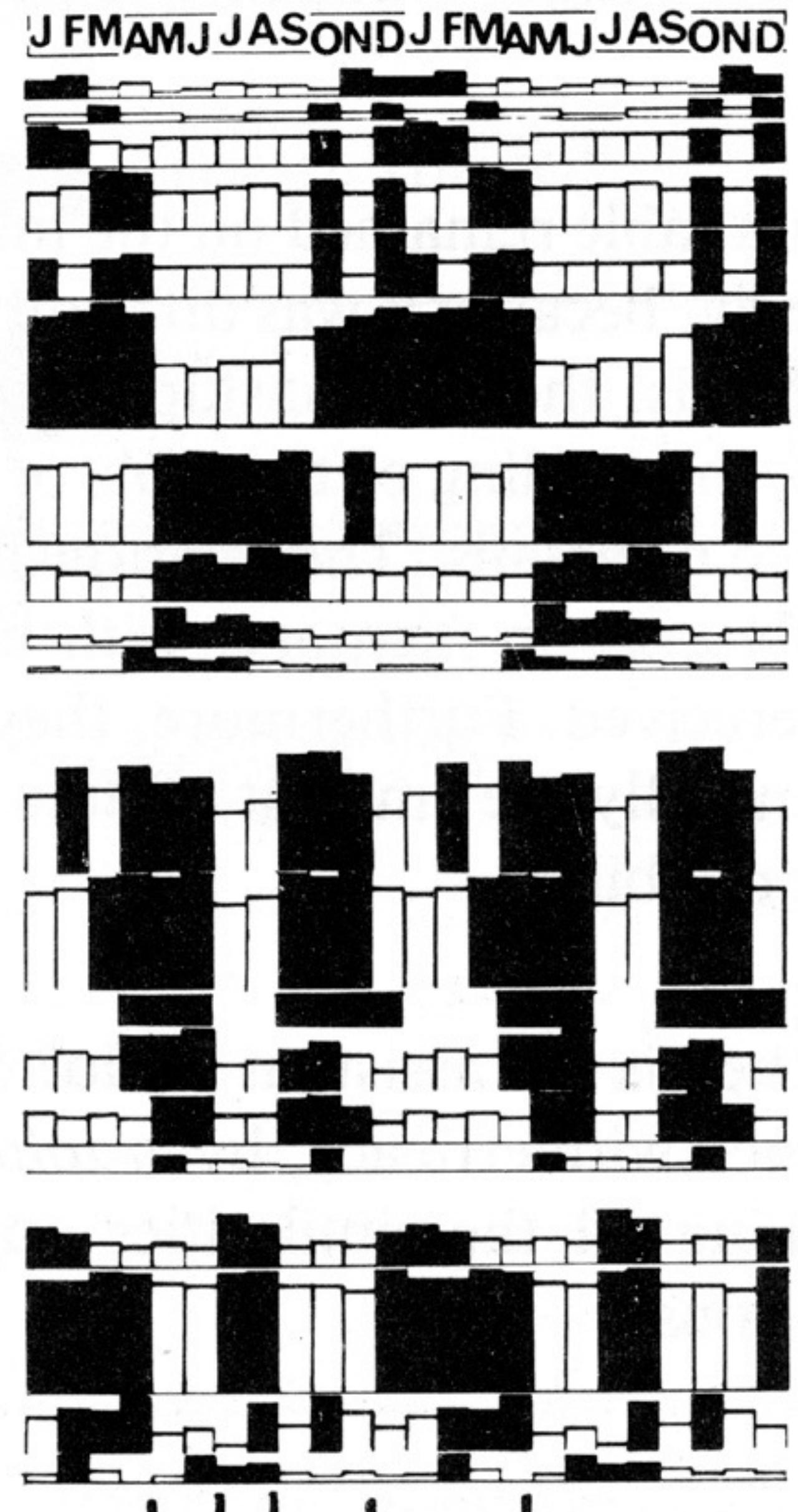




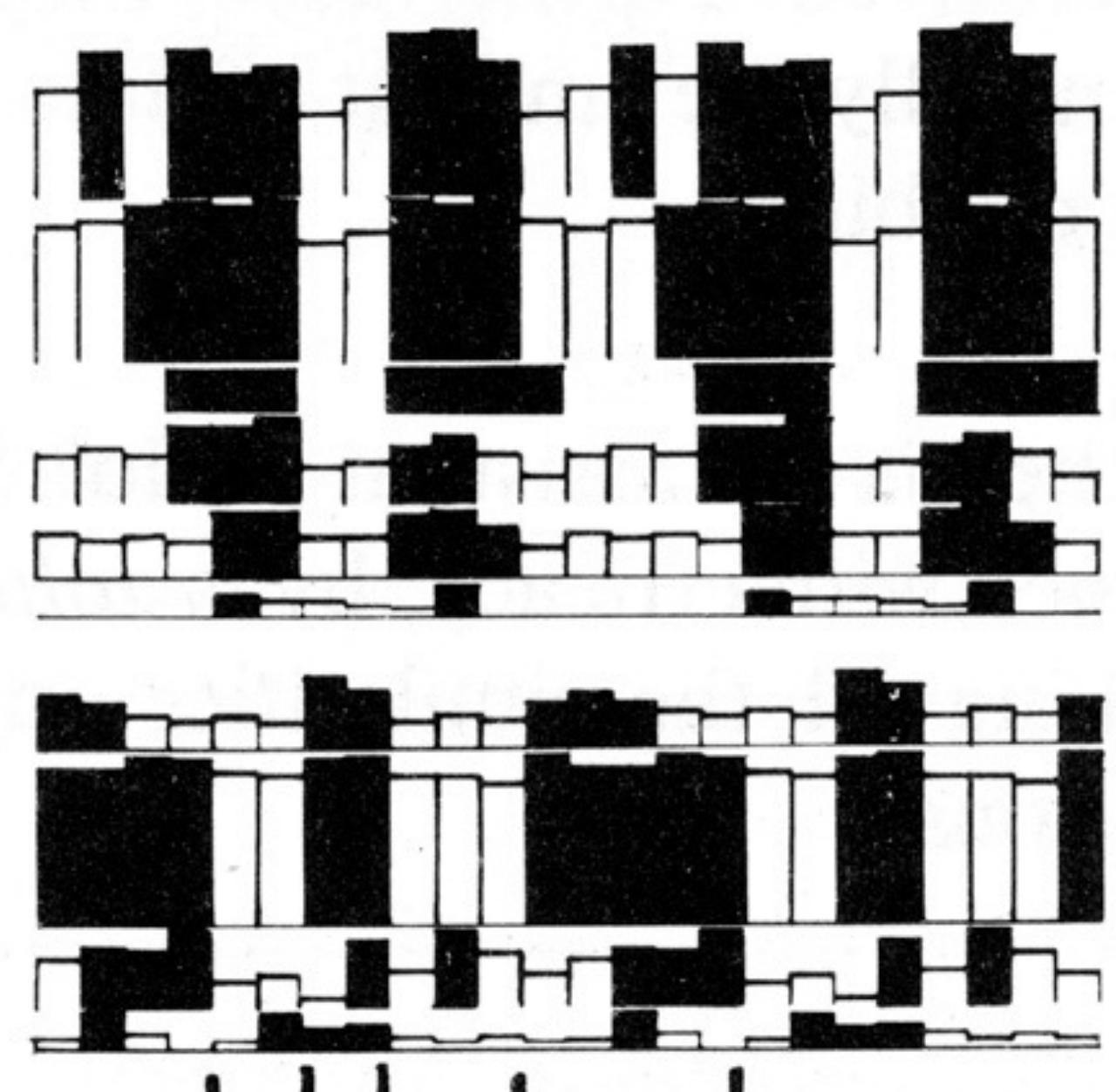
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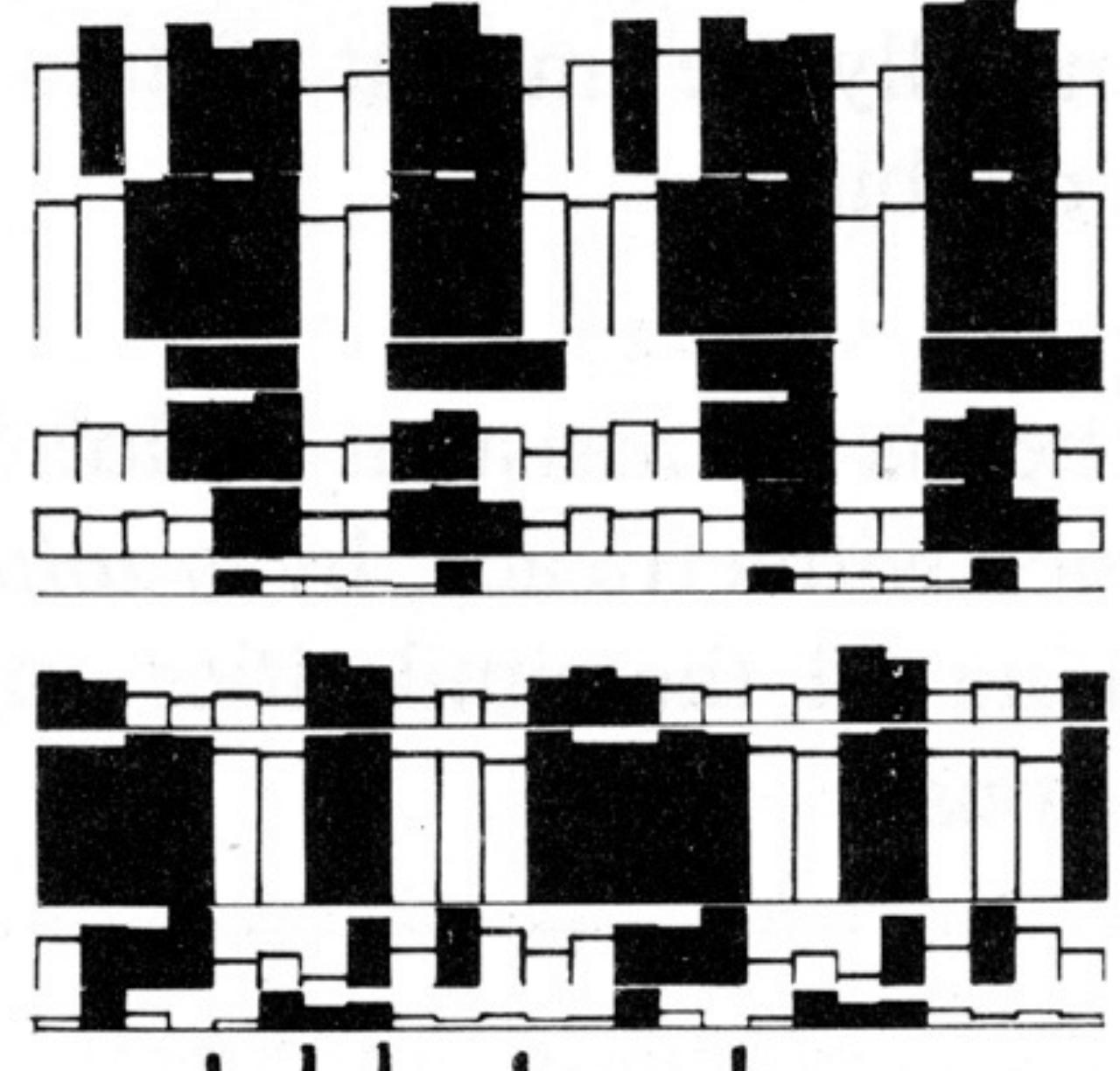
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3

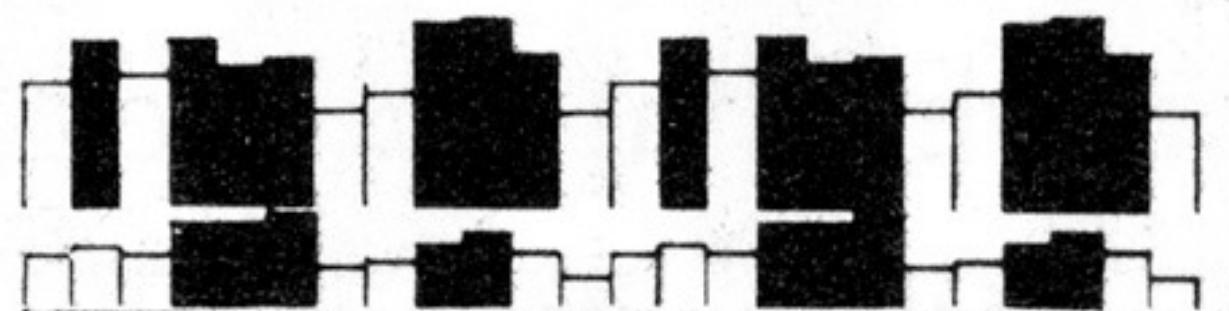


4



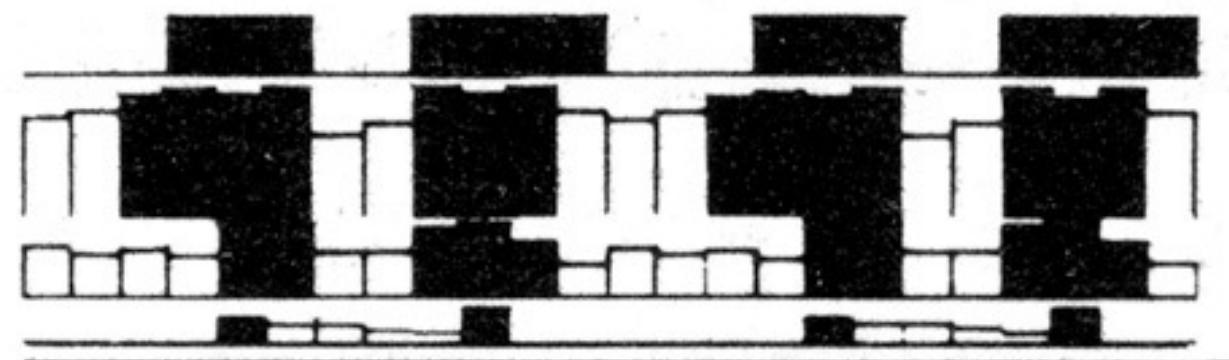
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18 % OCCUPANCY

18 LENGTH OF STAY



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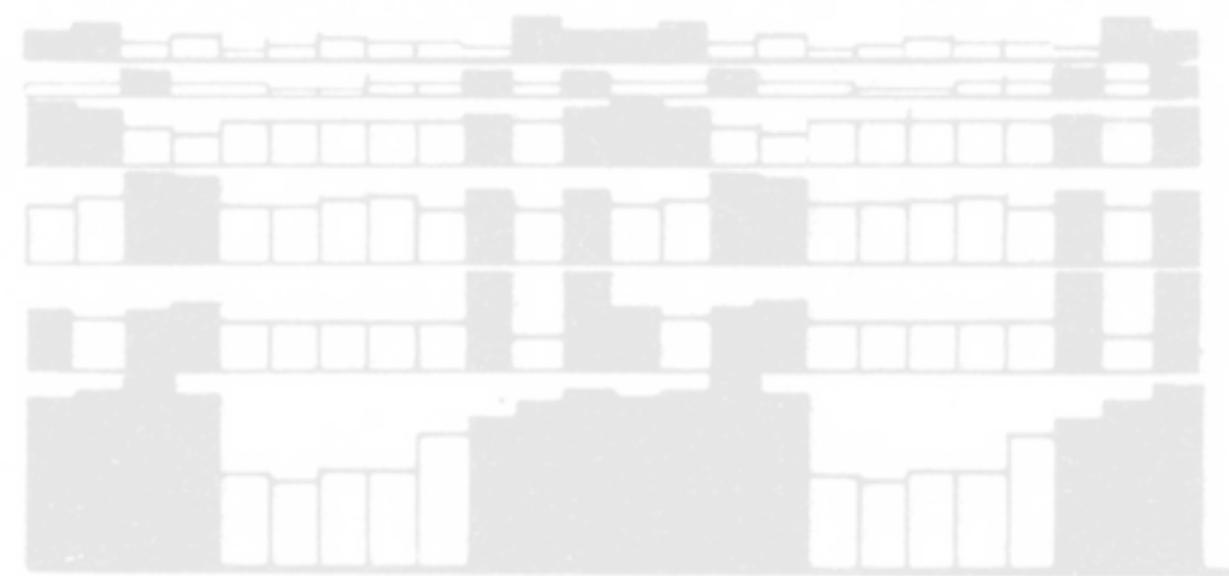
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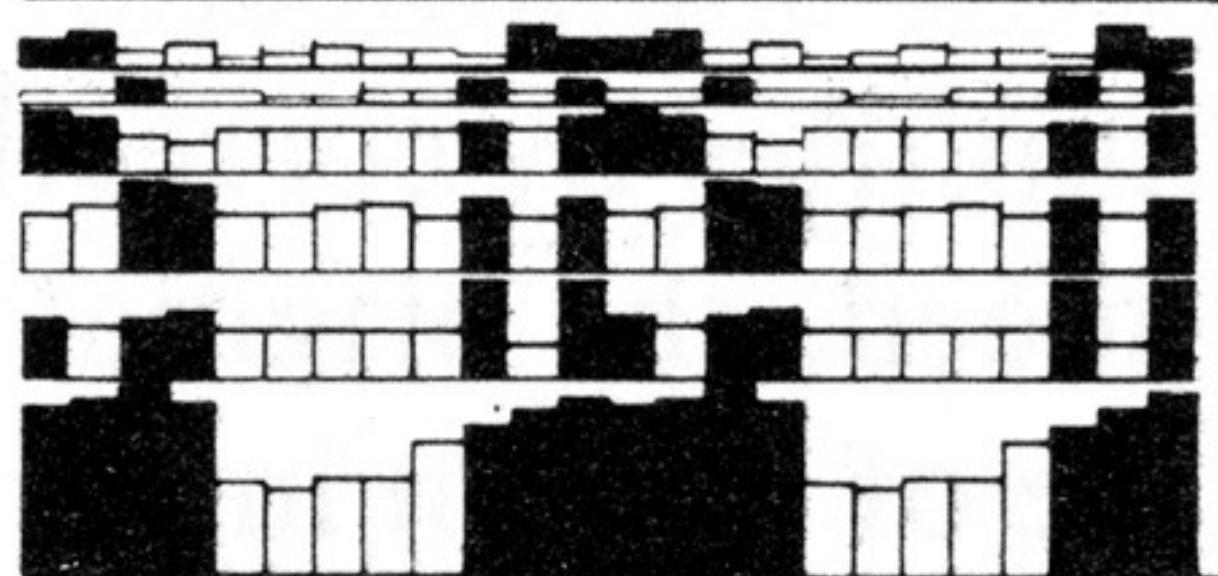
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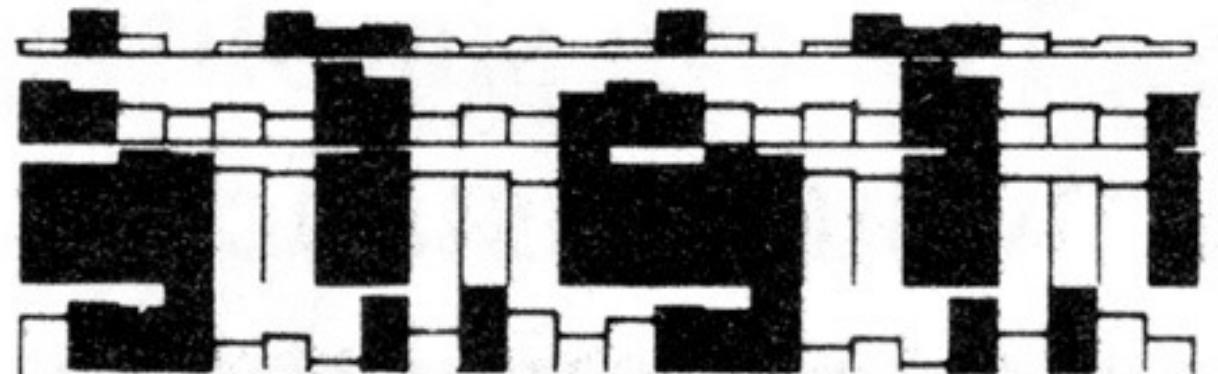
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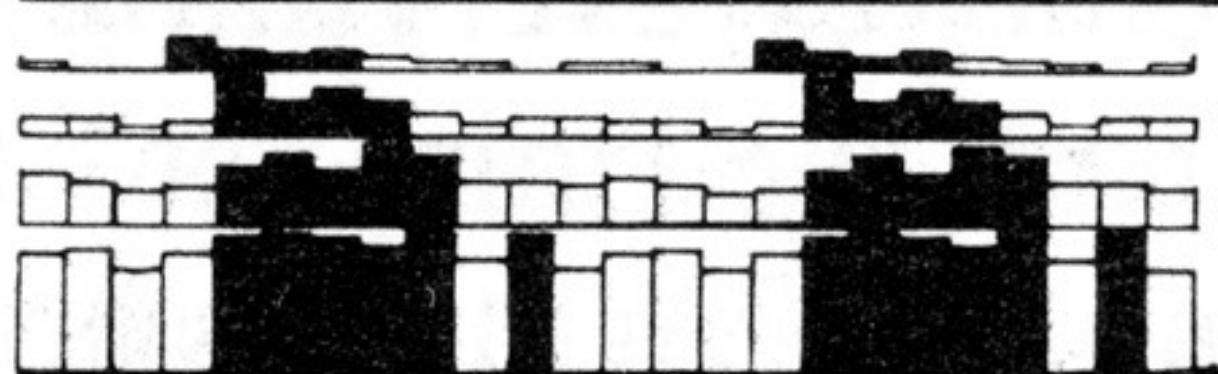


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8 MIDDLE EAST, AFRICA

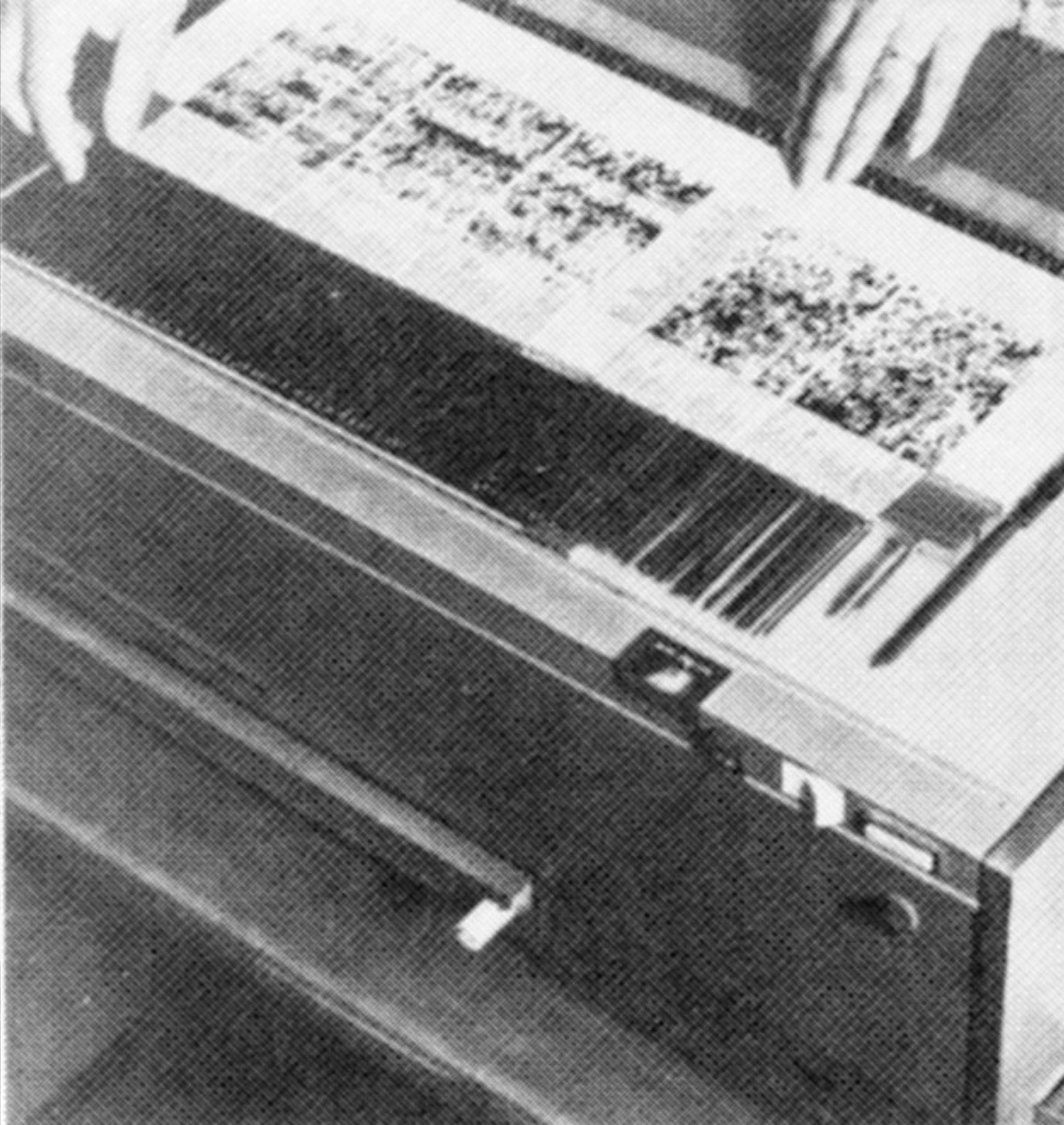
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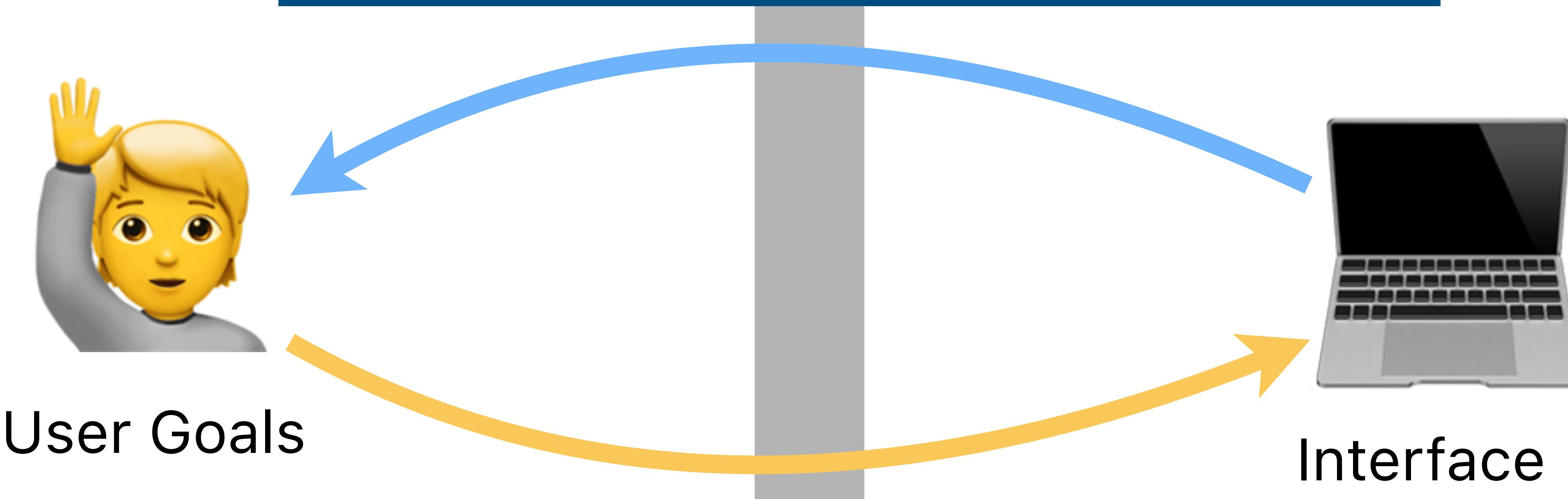
SUMMER



Interaction

Gulf of Evaluation

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



Gulf of Execution

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

Gulf of Evaluation

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



Goals

Edwin Hutchins



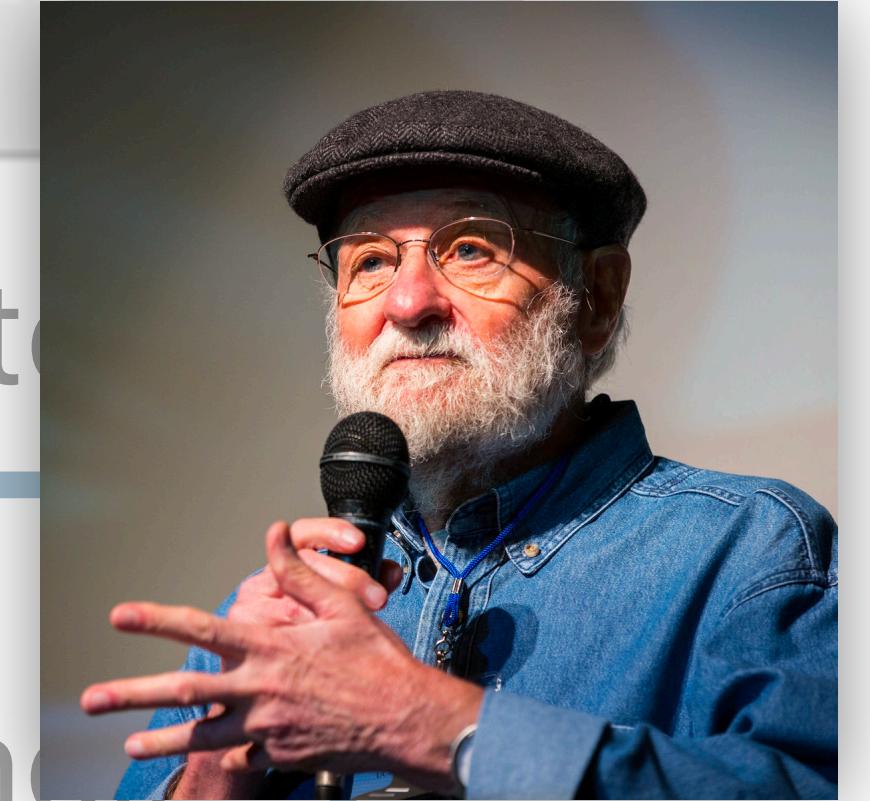
Gulf of Execution

The gap between a user's goals and their ability to achieve those goals by interacting with the system.

Jim Hollan



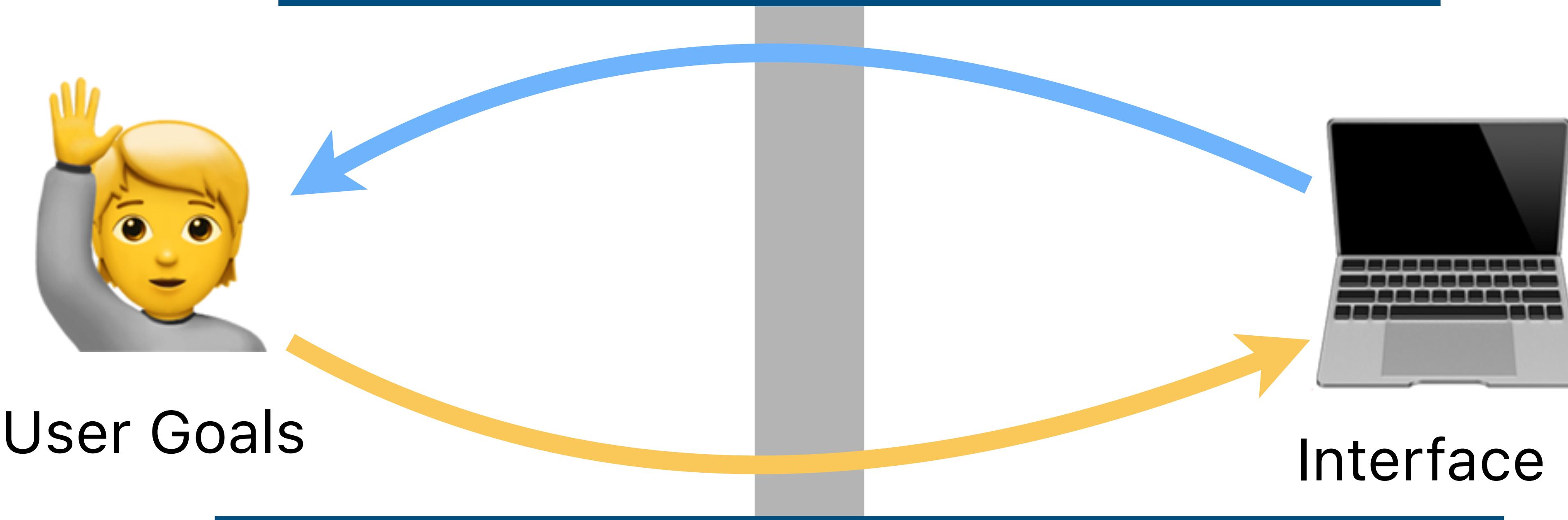
Inter



Don Norman

Gulf of Evaluation

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



Gulf of Execution

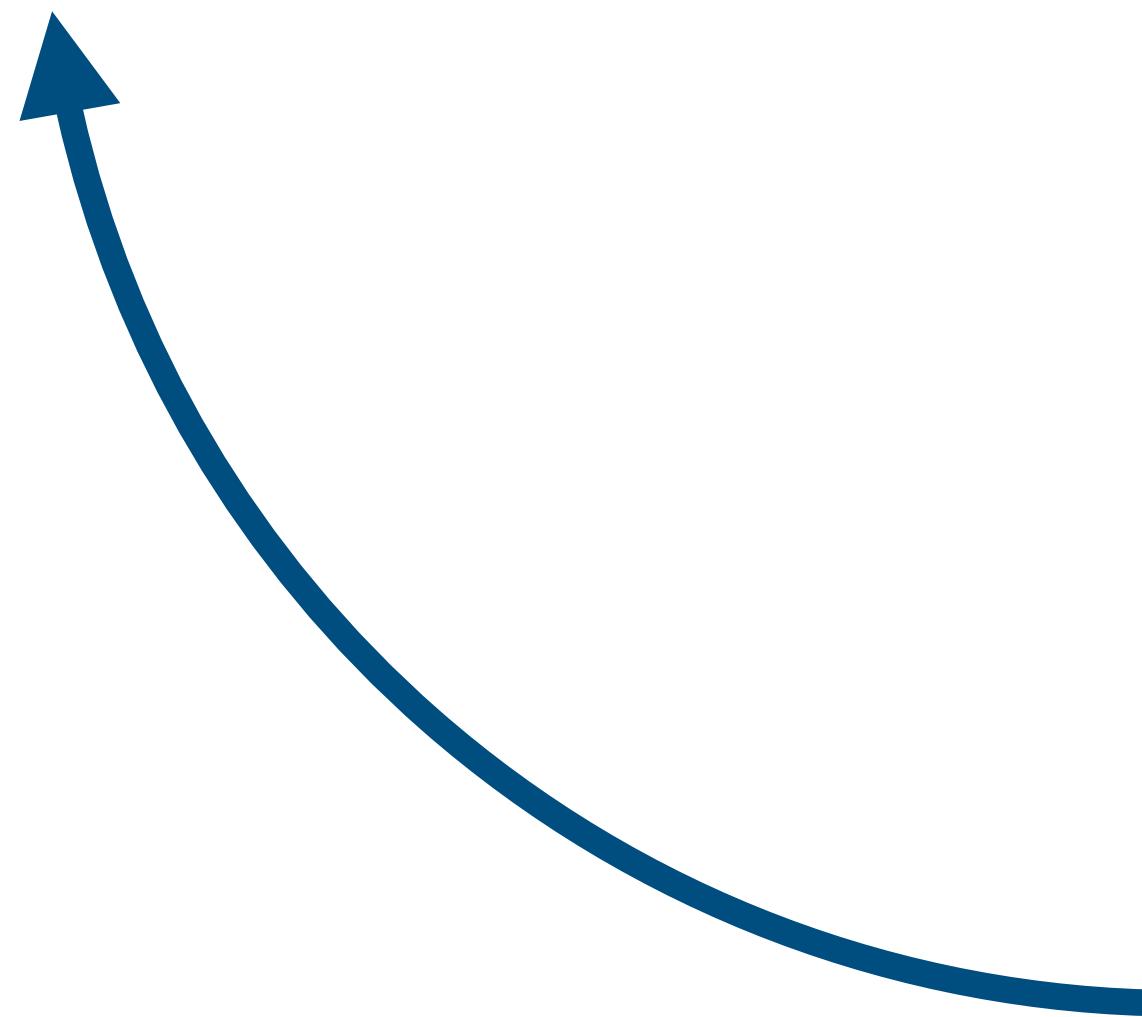
The gap between the user's goals and their ability to achieve them using the system.

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]
```

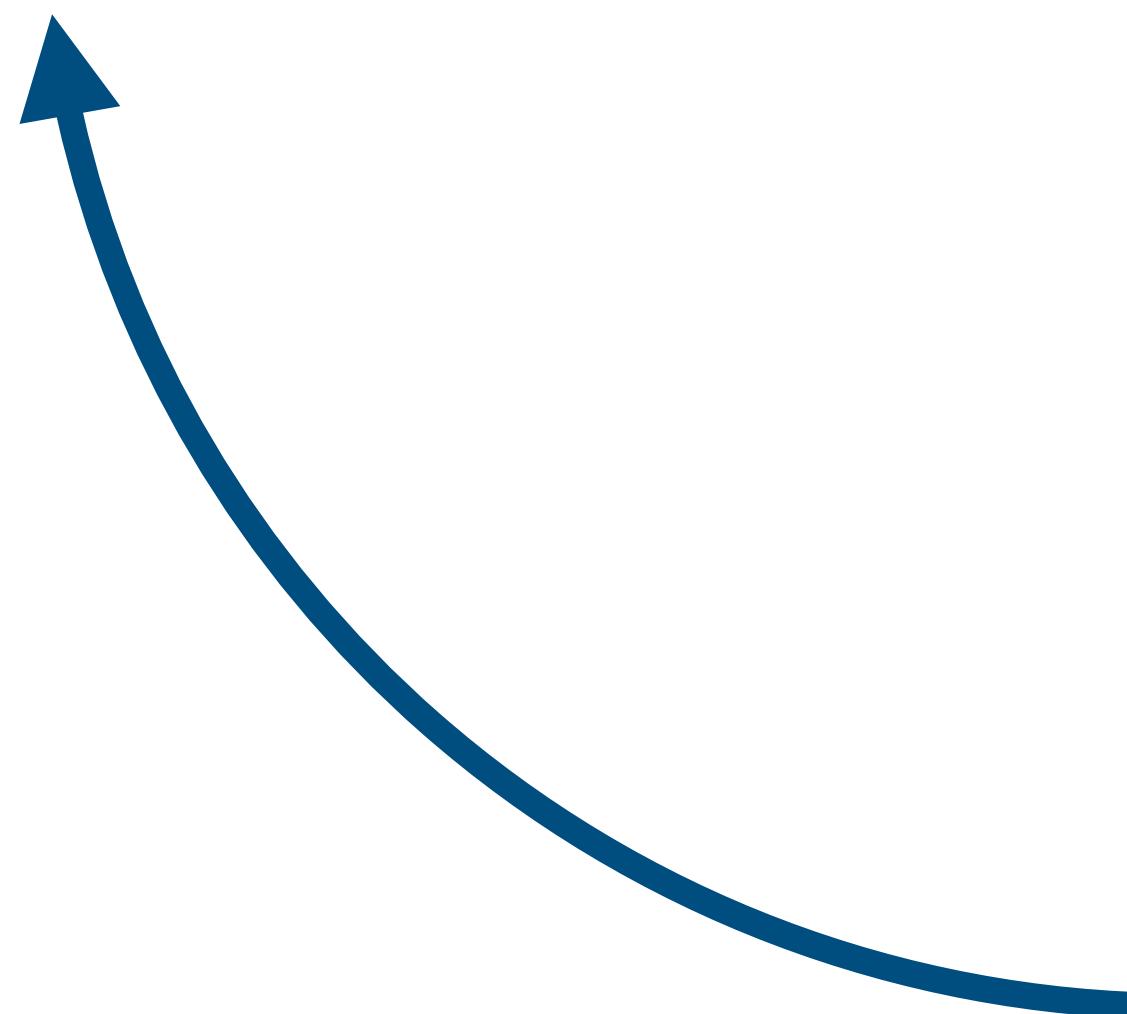


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df.sort_values('price',  
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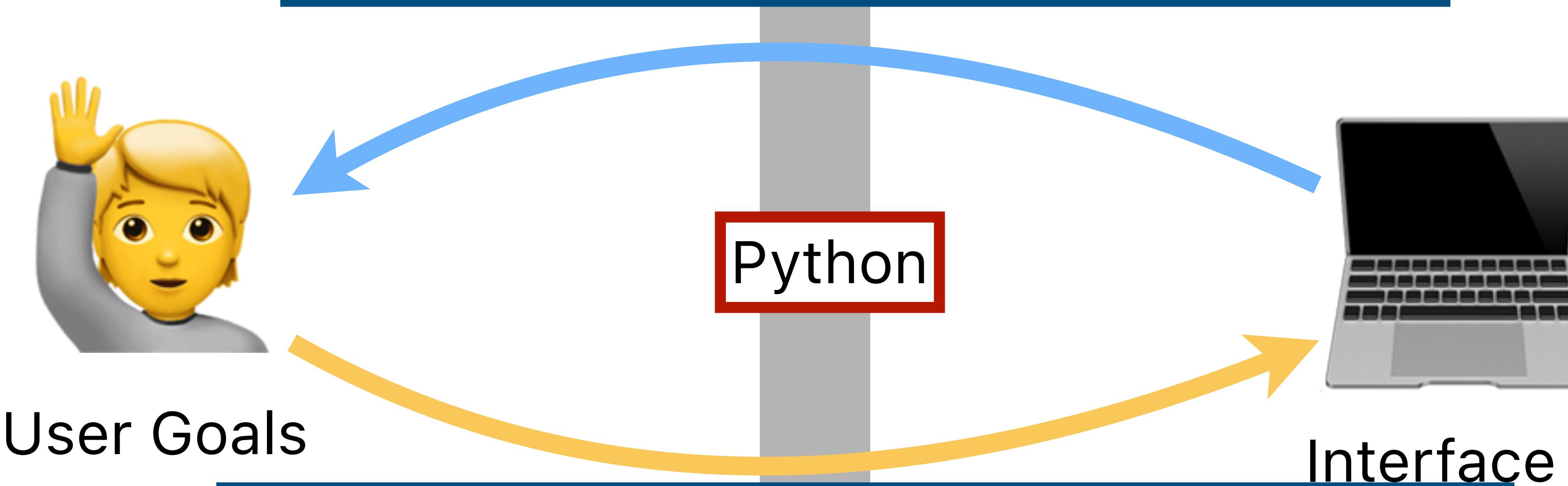
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10/4	AMZN	965.45
10/4	MSFT	74.69

symbol	avg(price)
AMZN	961.275
MSFT	74.475

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

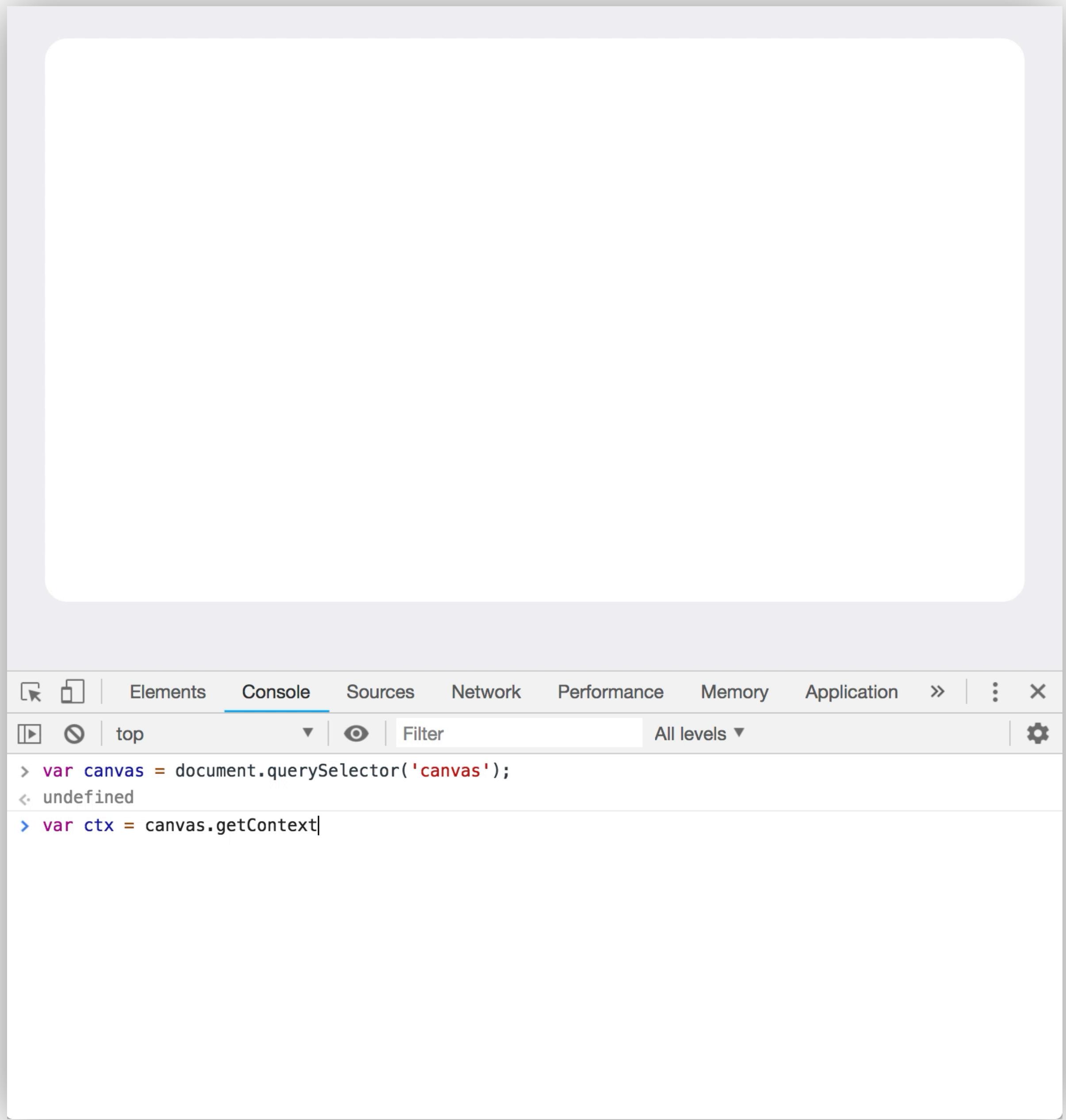
Gulf of Evaluation

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



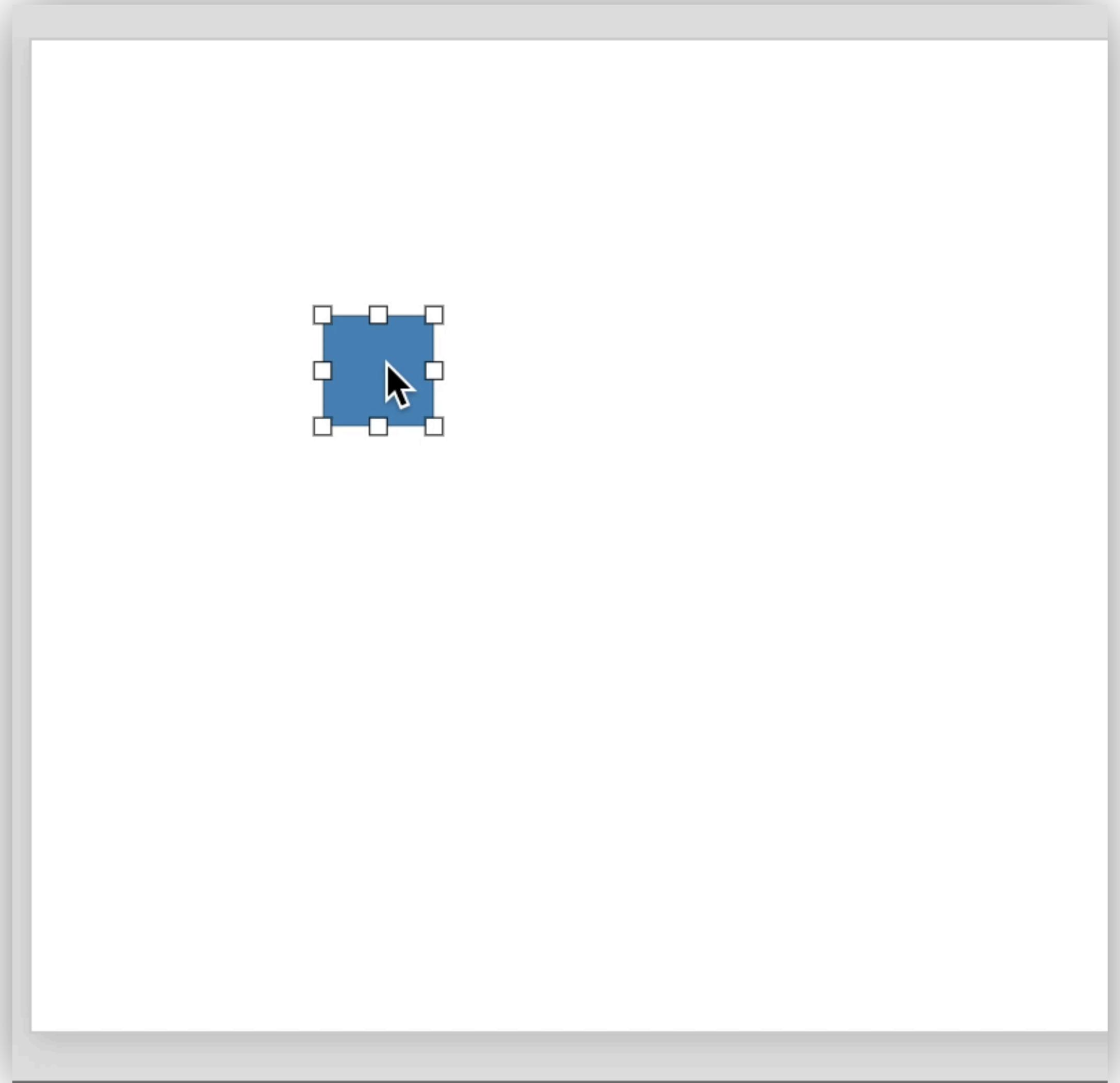
Gulf of Execution

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



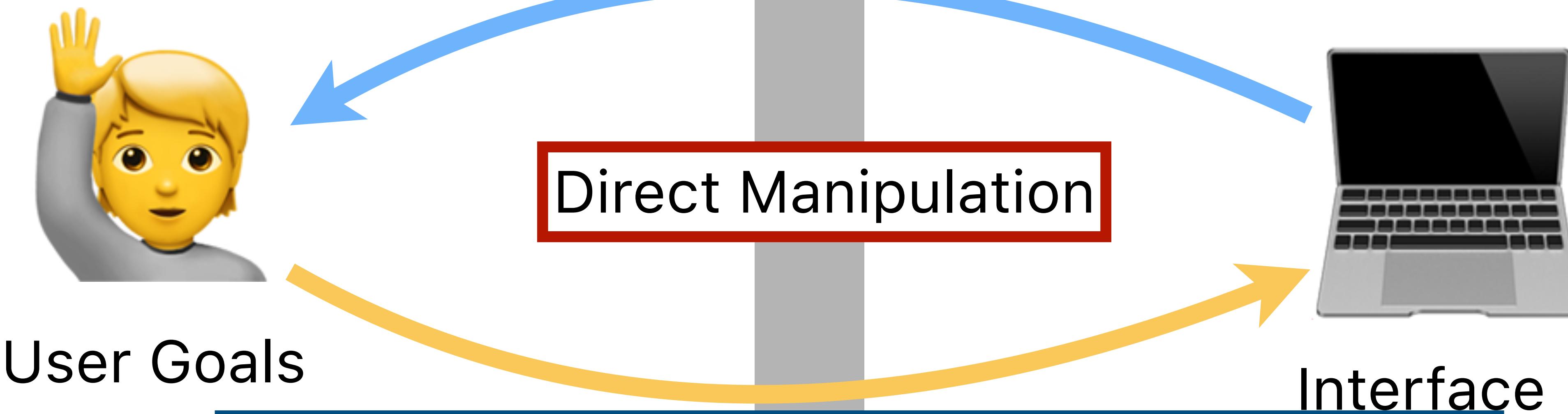
The screenshot shows the Chrome DevTools interface with the "Console" tab selected. The console window displays the following JavaScript code:

```
> var canvas = document.querySelector('canvas');
< undefined
> var ctx = canvas.getContext()
```



Gulf of Evaluation

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



Gulf of Execution

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

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.

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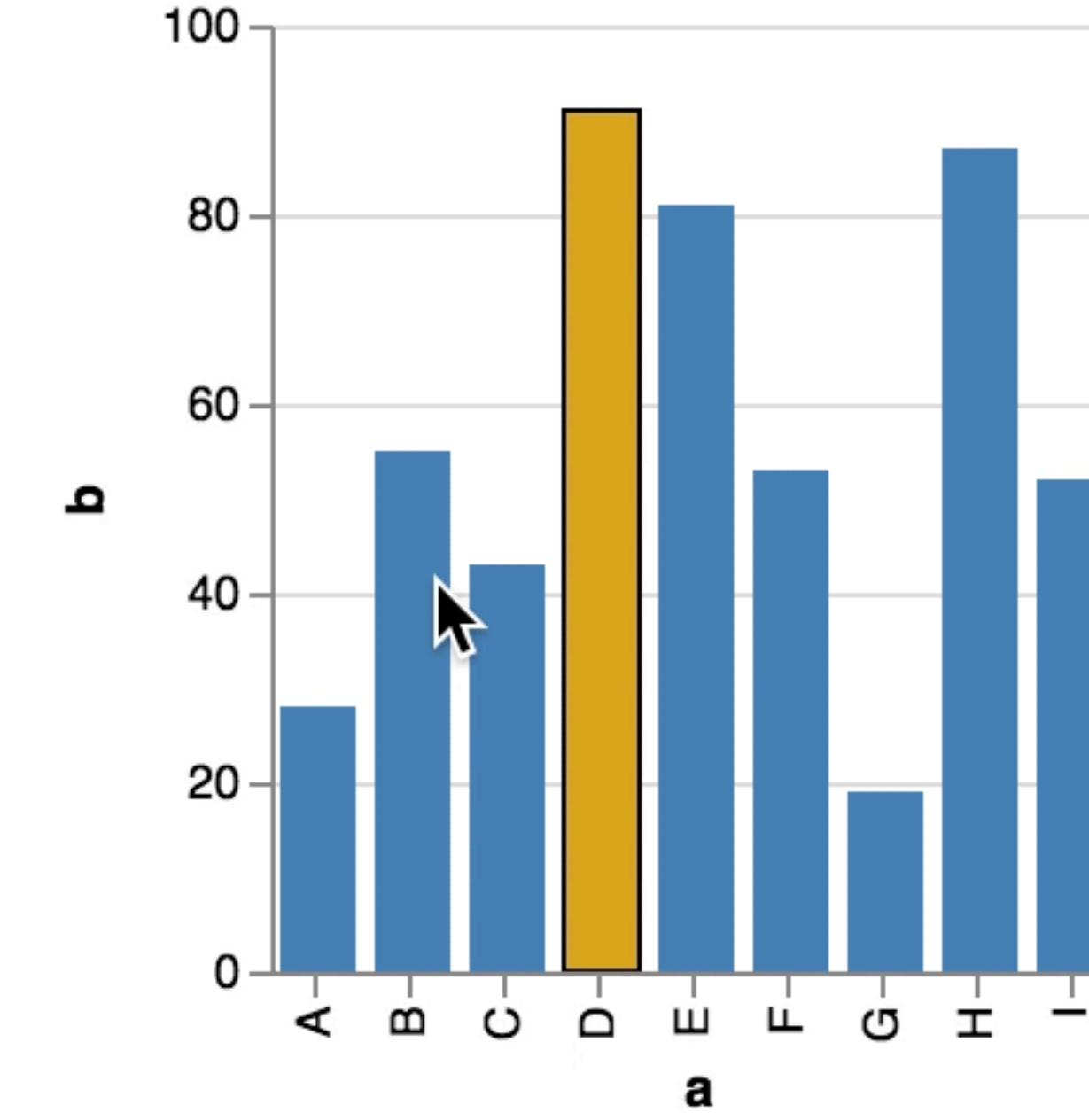
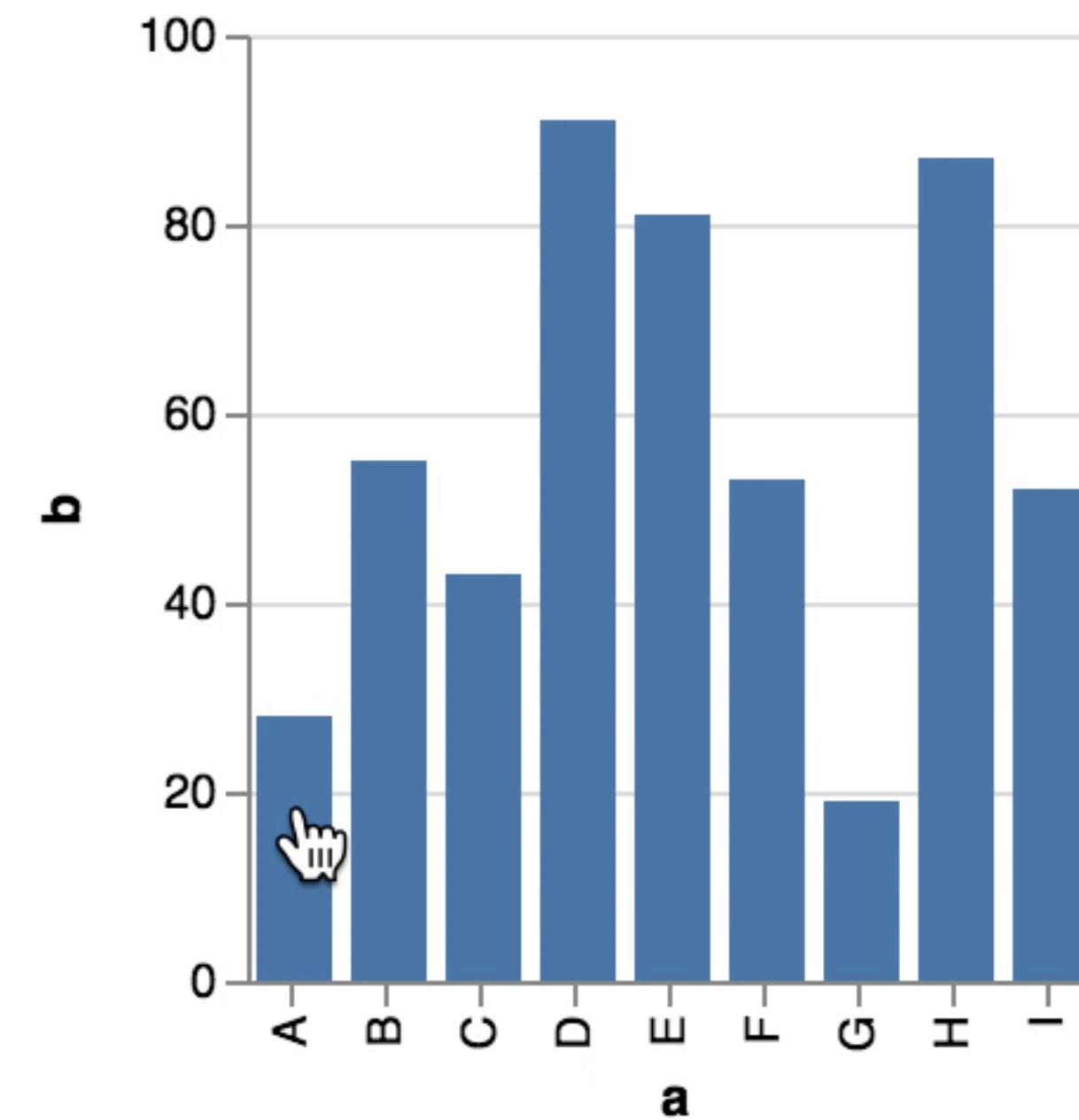
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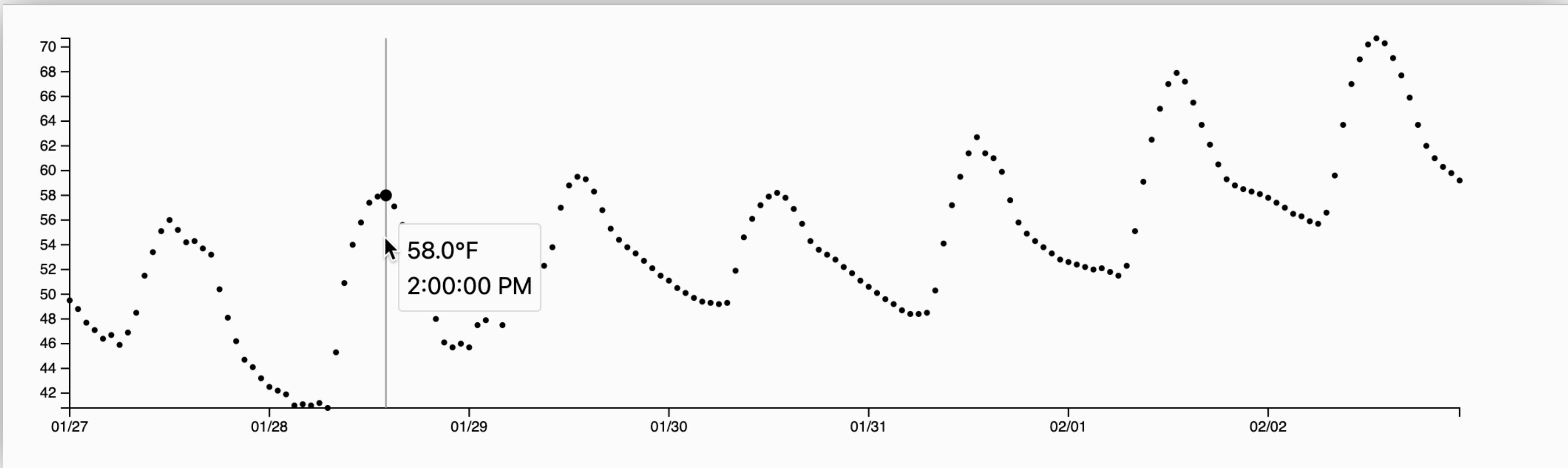
Point Selection

Select discrete data values.

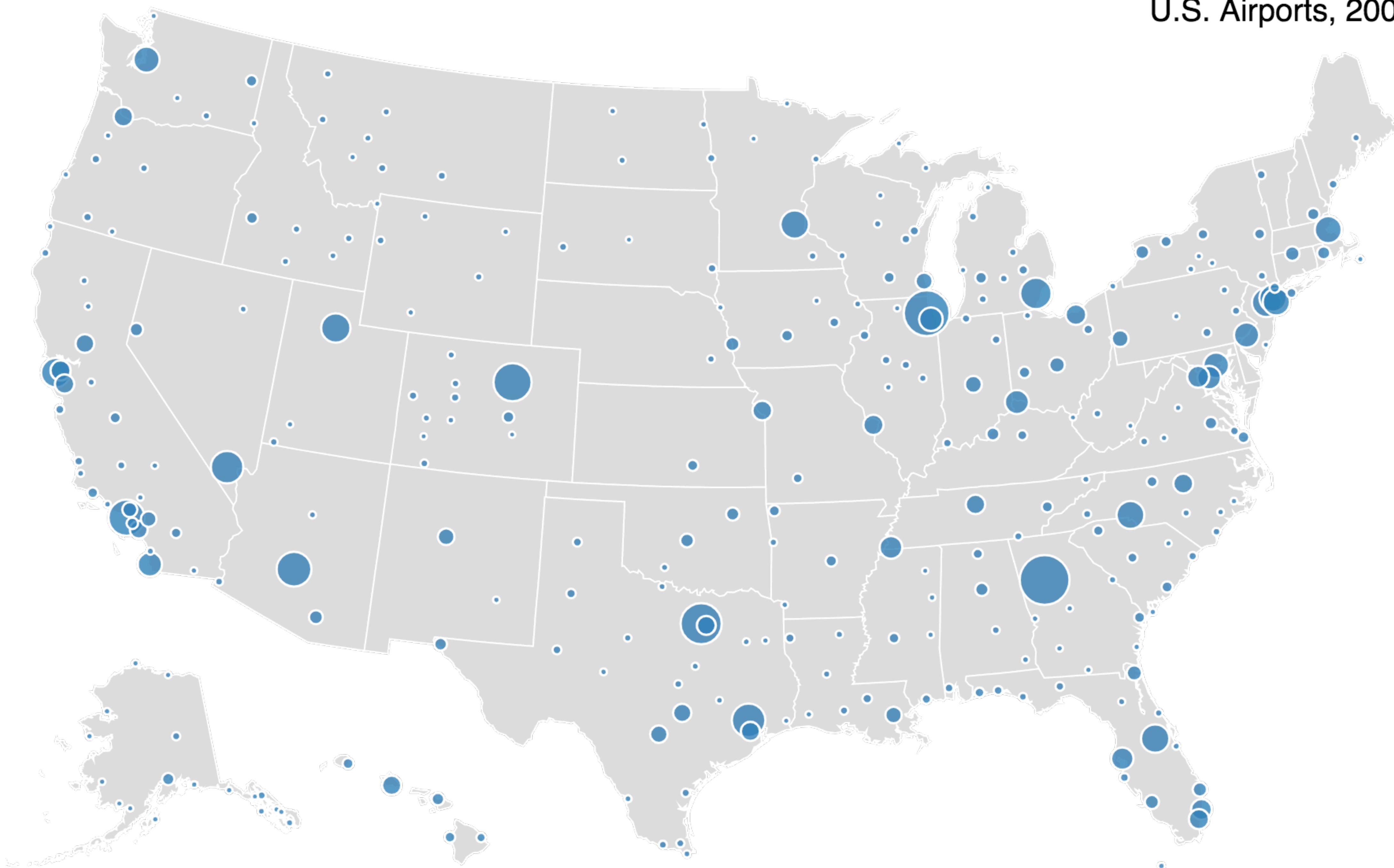
- How many points are selected? 1, 2, 3, ...
- How are points selected? Mouse hover, click, tap, ...



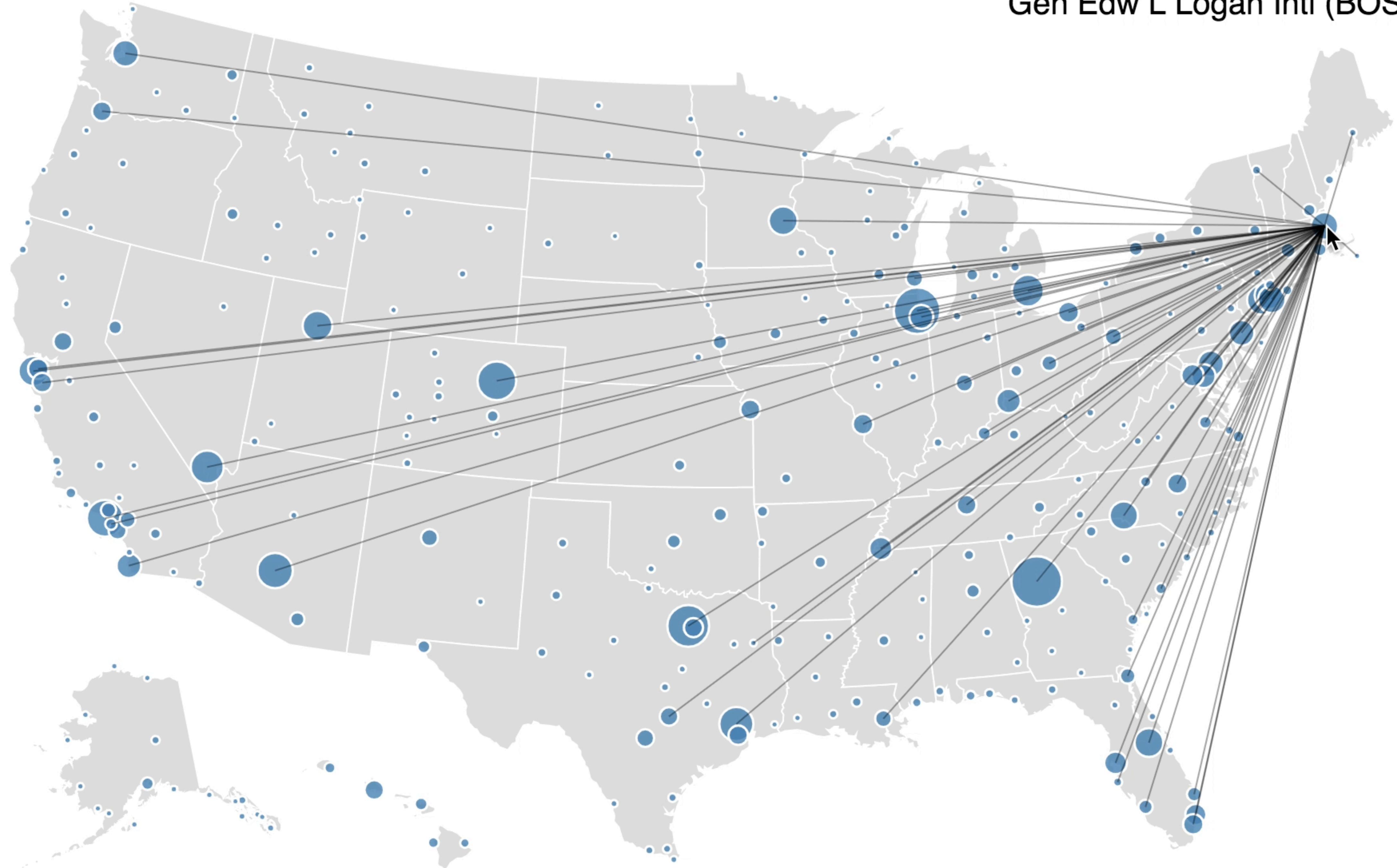
Point Selection



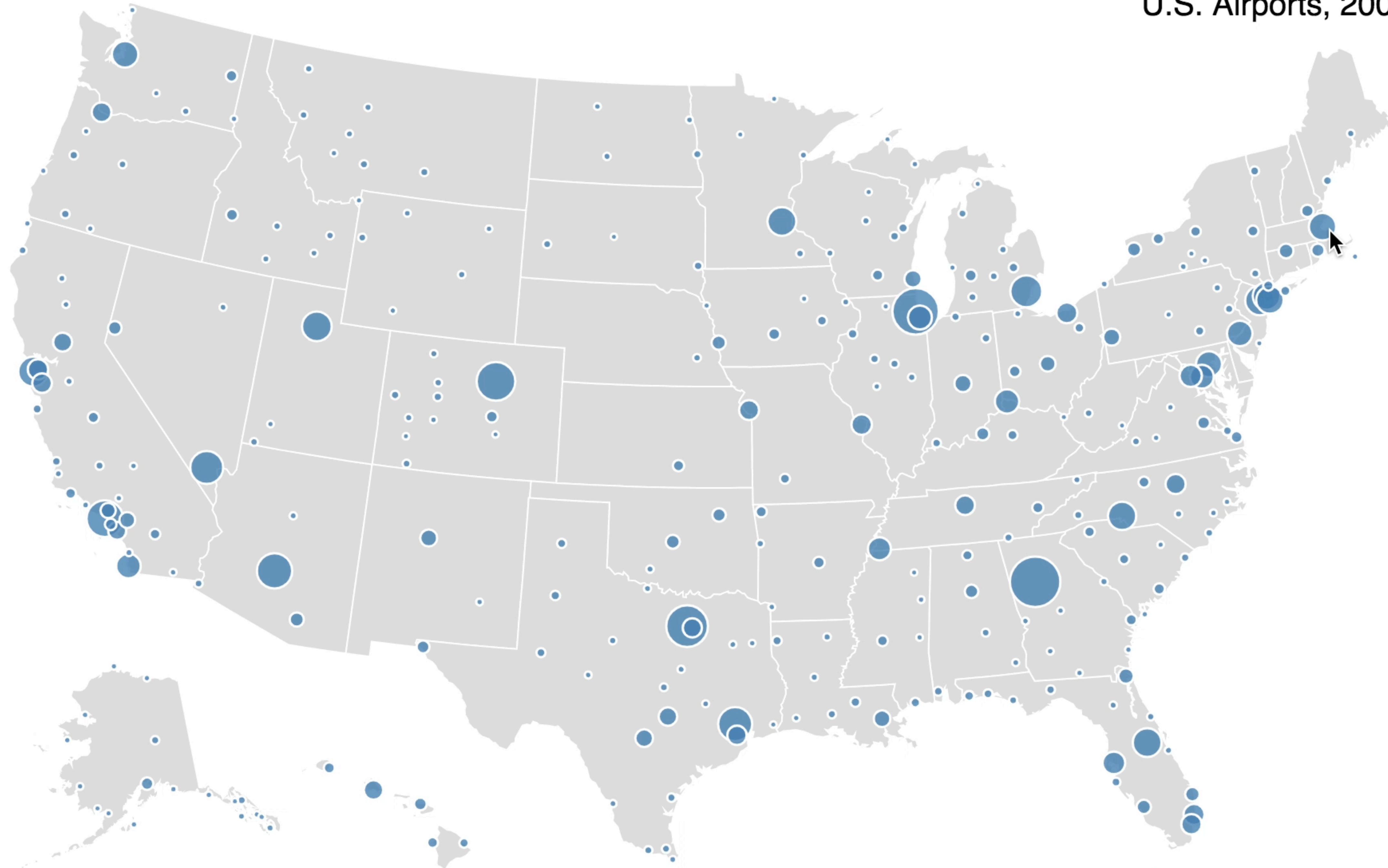
U.S. Airports, 2008



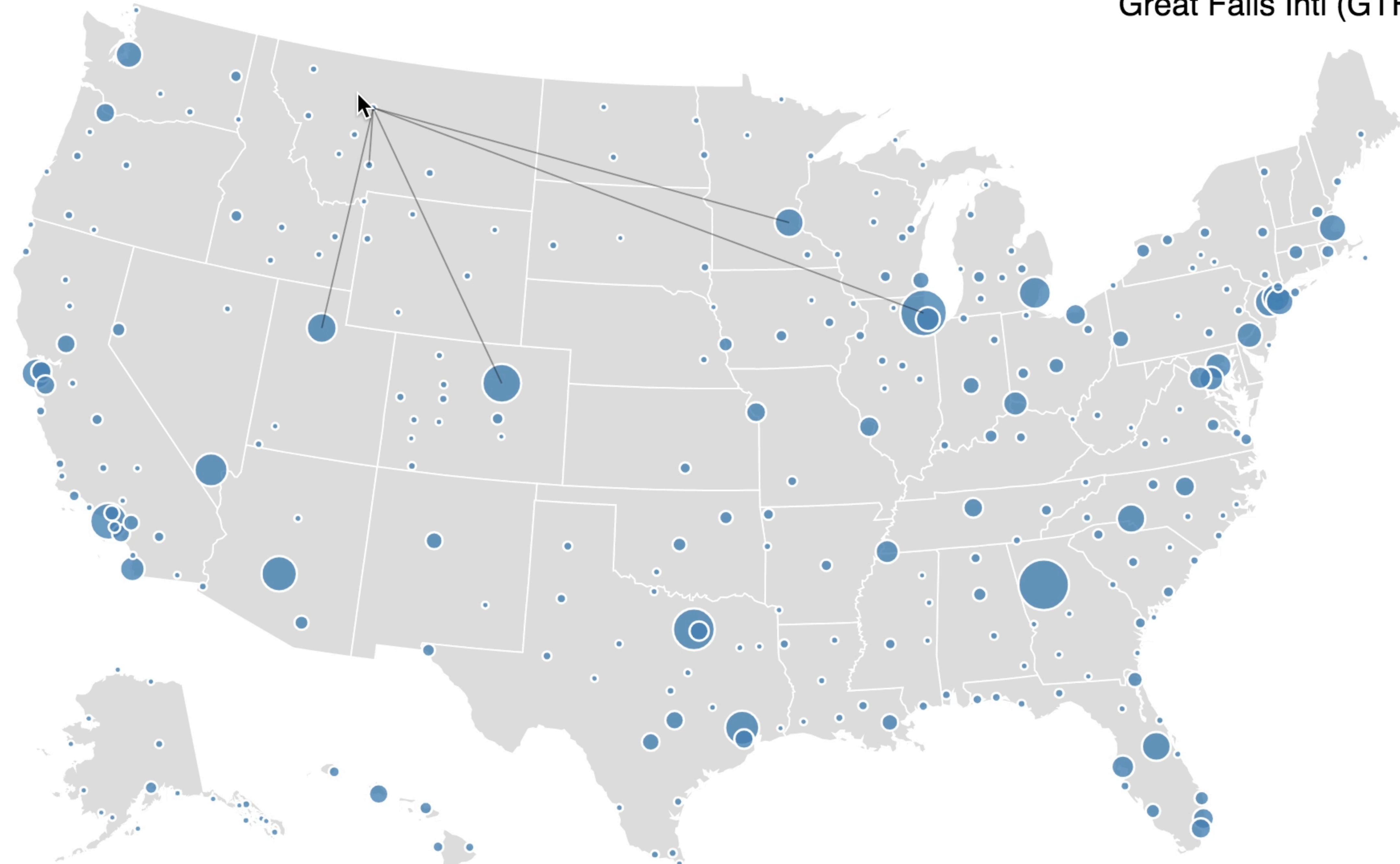
Gen Edw L Logan Intl (BOS)



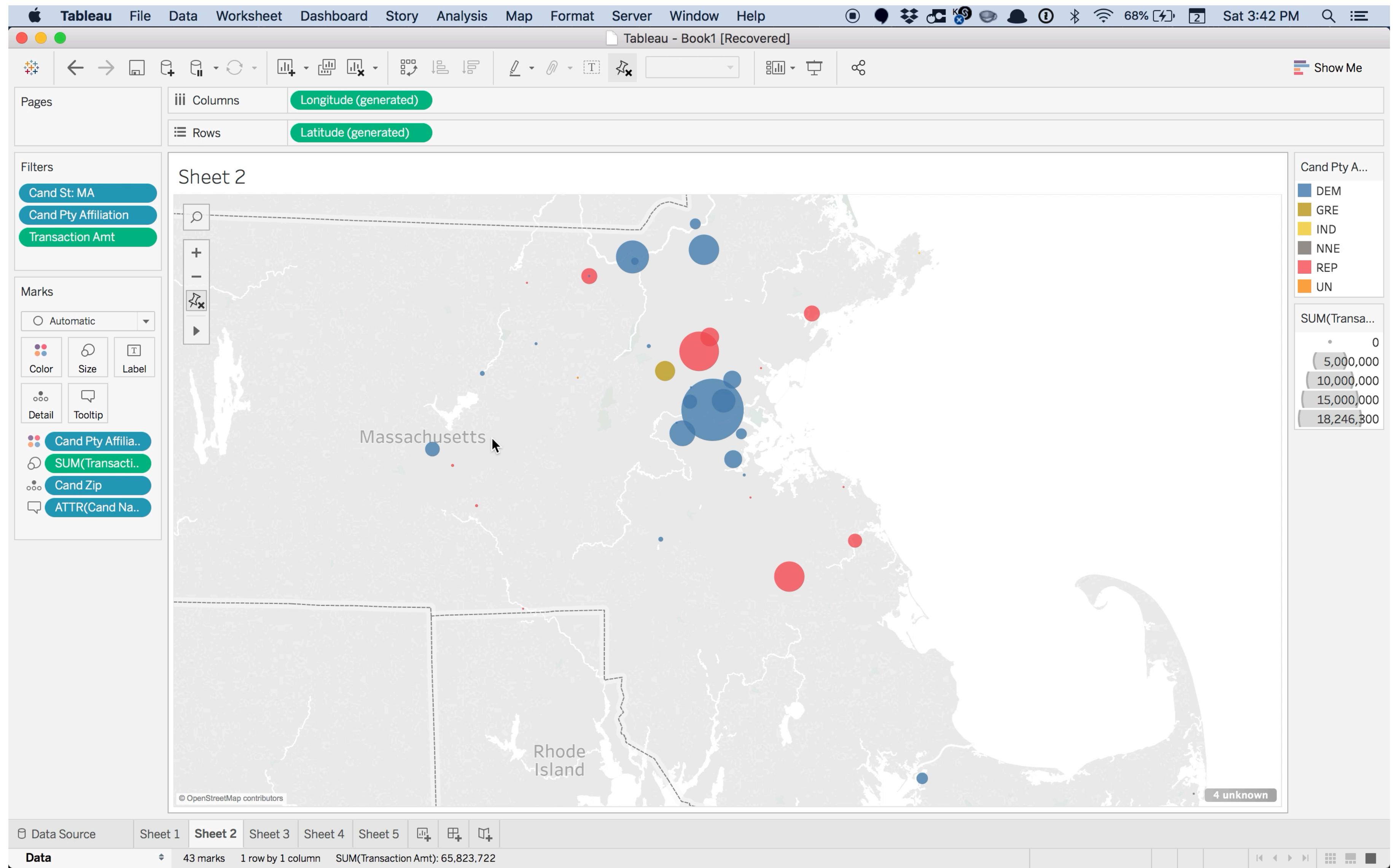
U.S. Airports, 2008



Great Falls Intl (GTF)



Region Selection



Interaction in Visualization

Select identify something as interesting.

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Encode show me a different visual representation.

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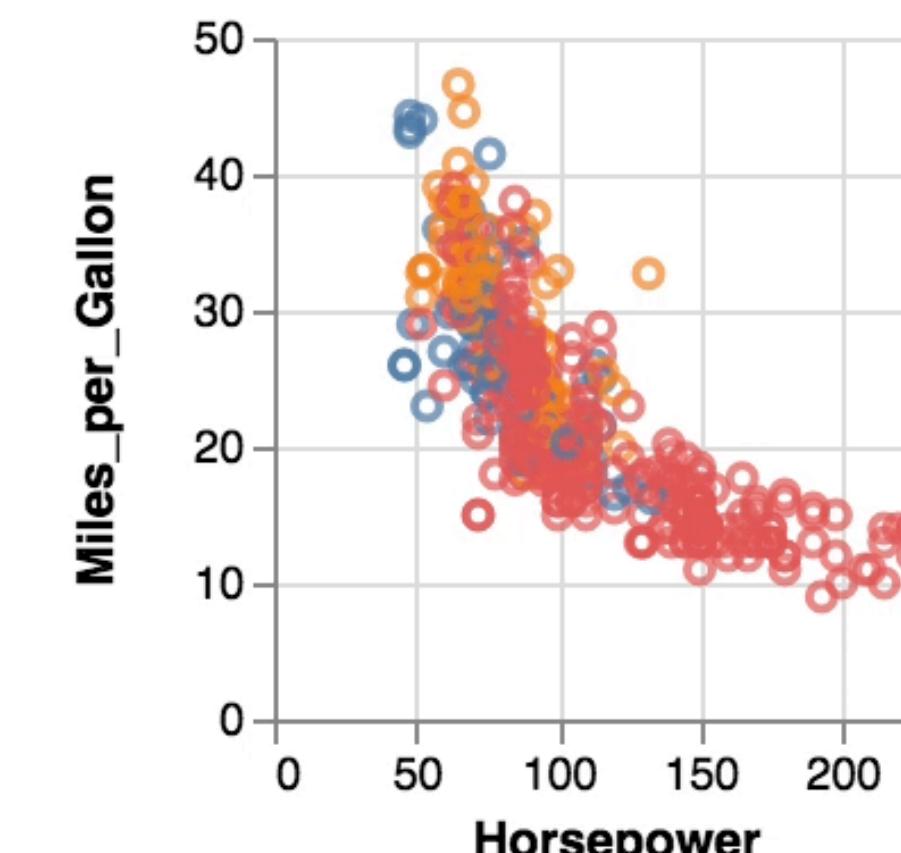
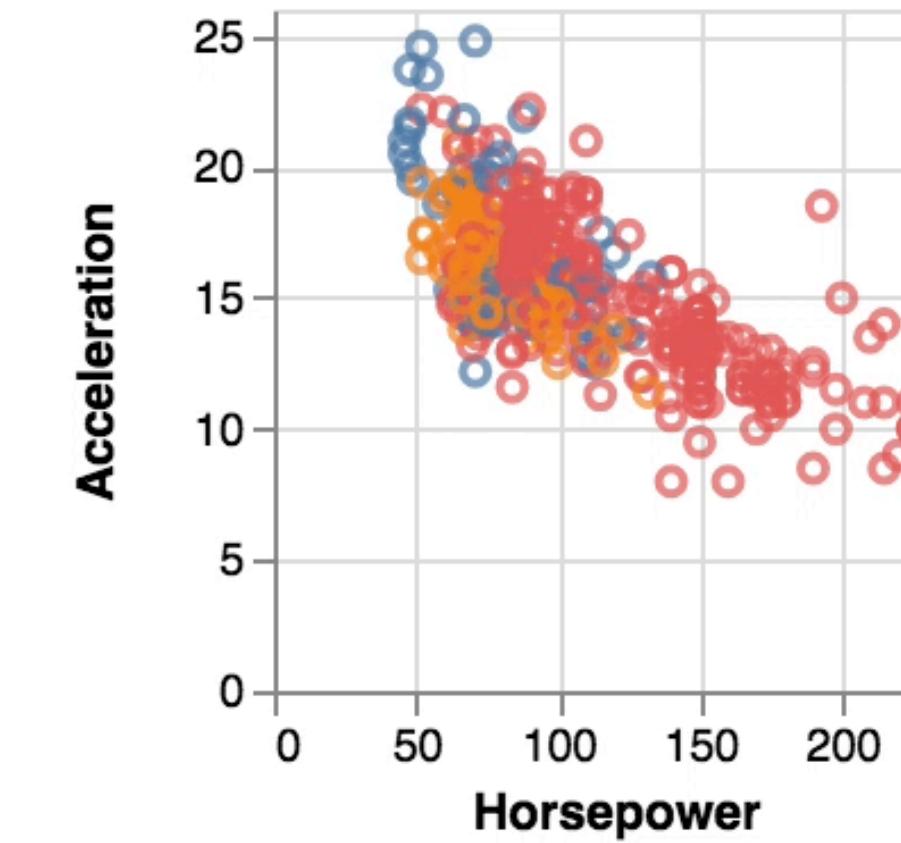
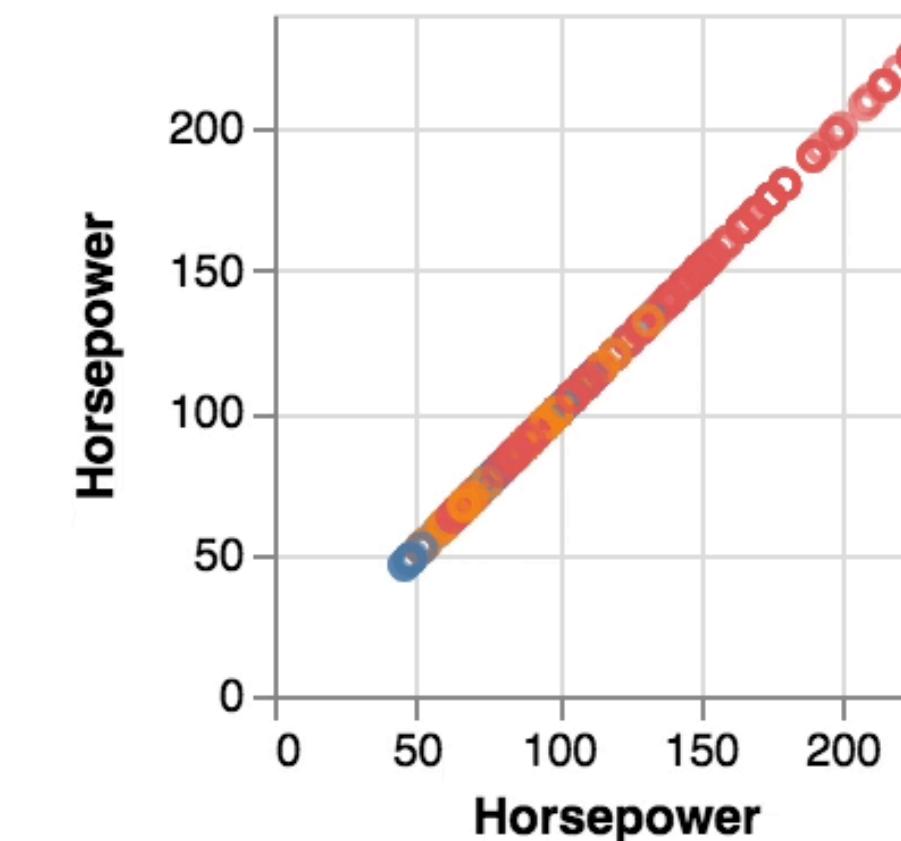
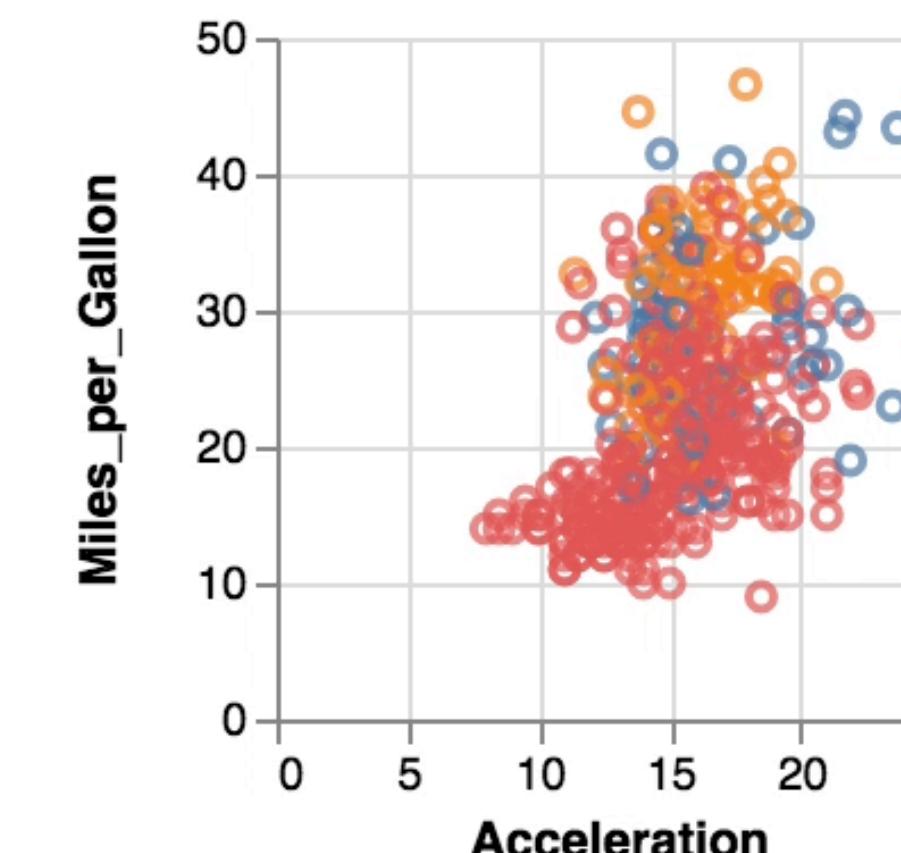
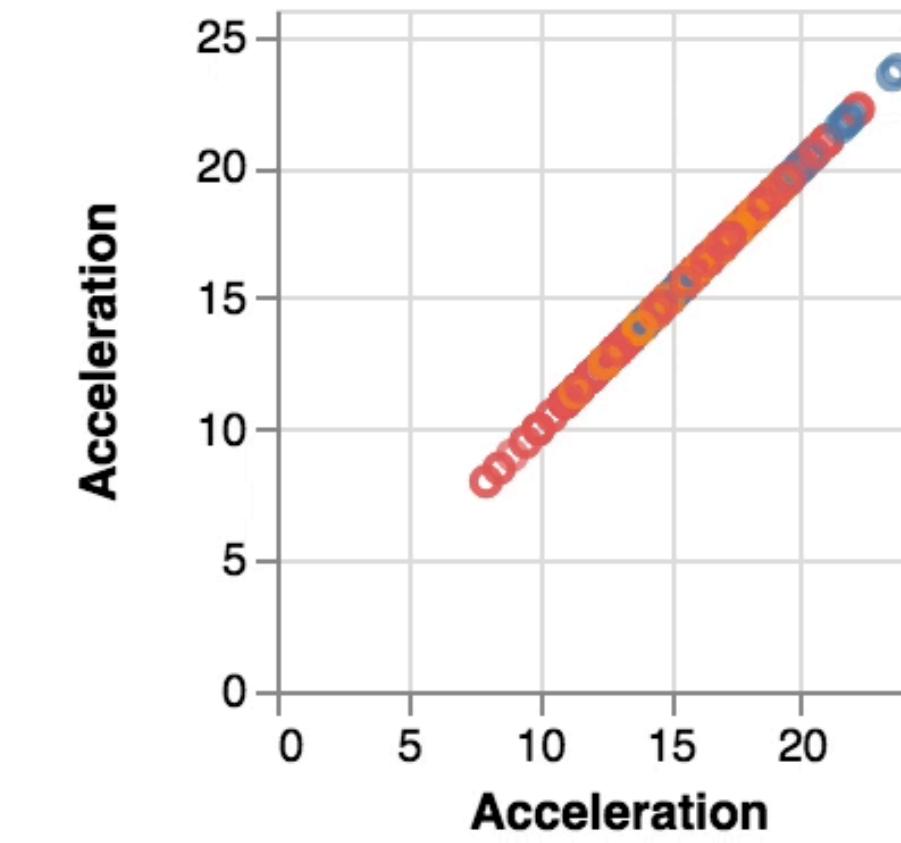
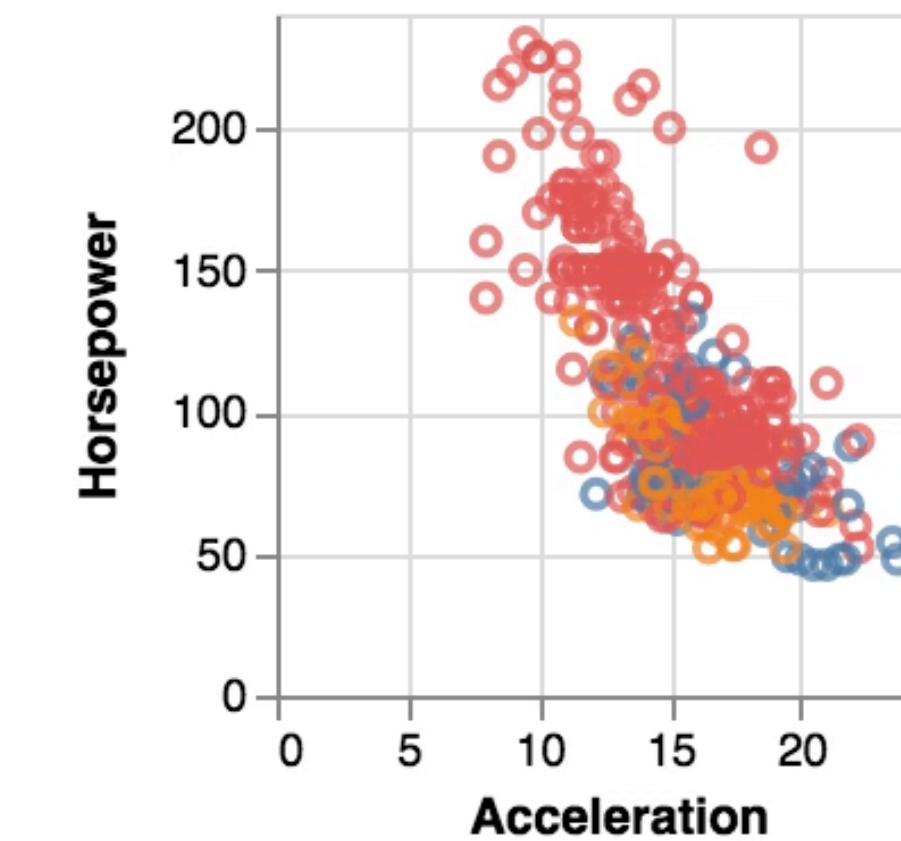
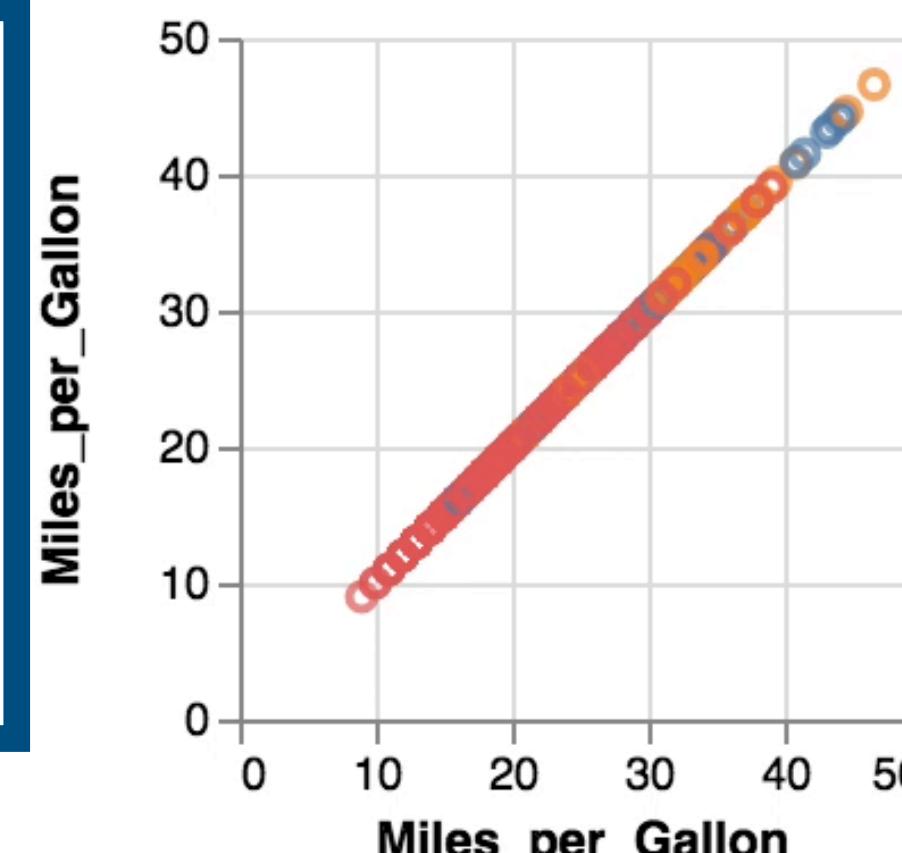
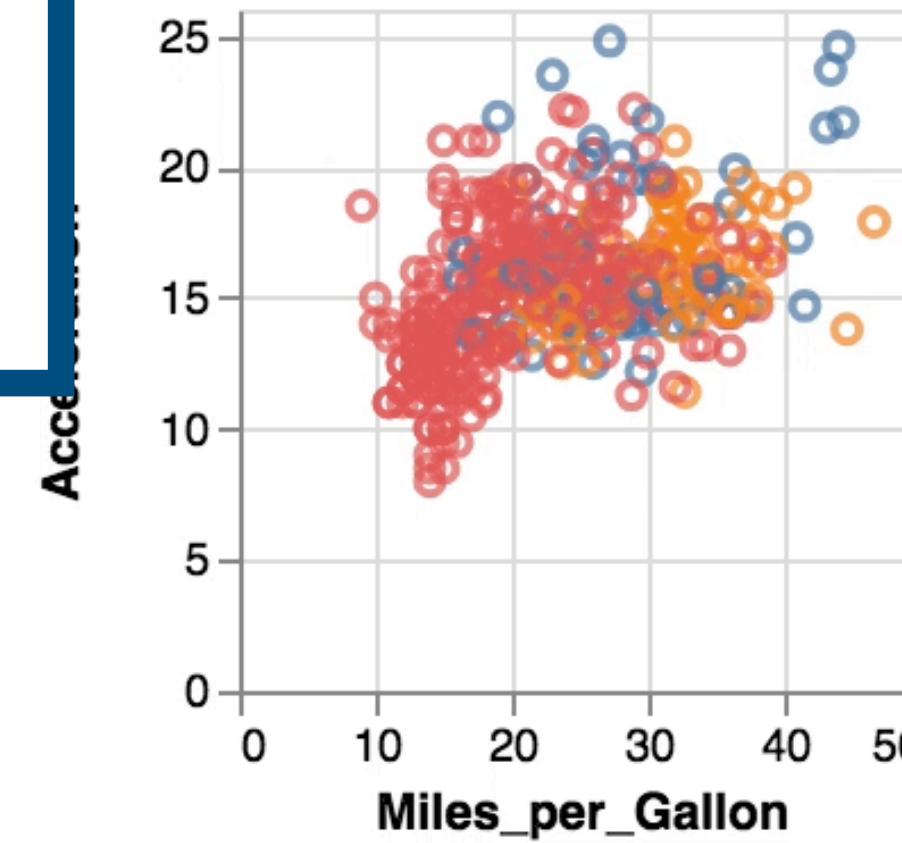
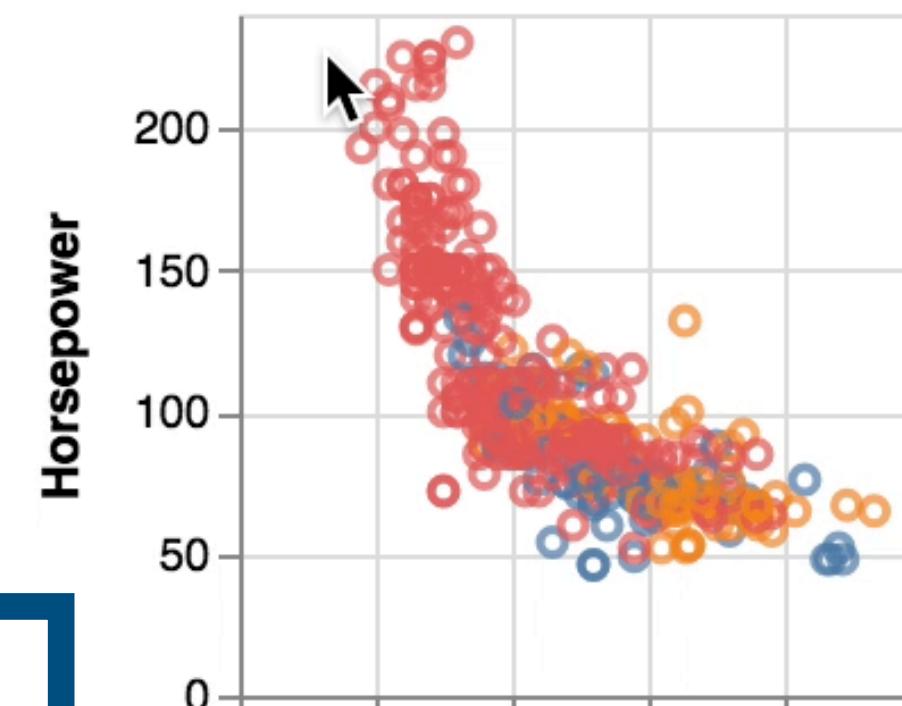
Reconfigure show me a different arrangement.

Explore show me something else.

Encode show me a different visual representation.

Connect

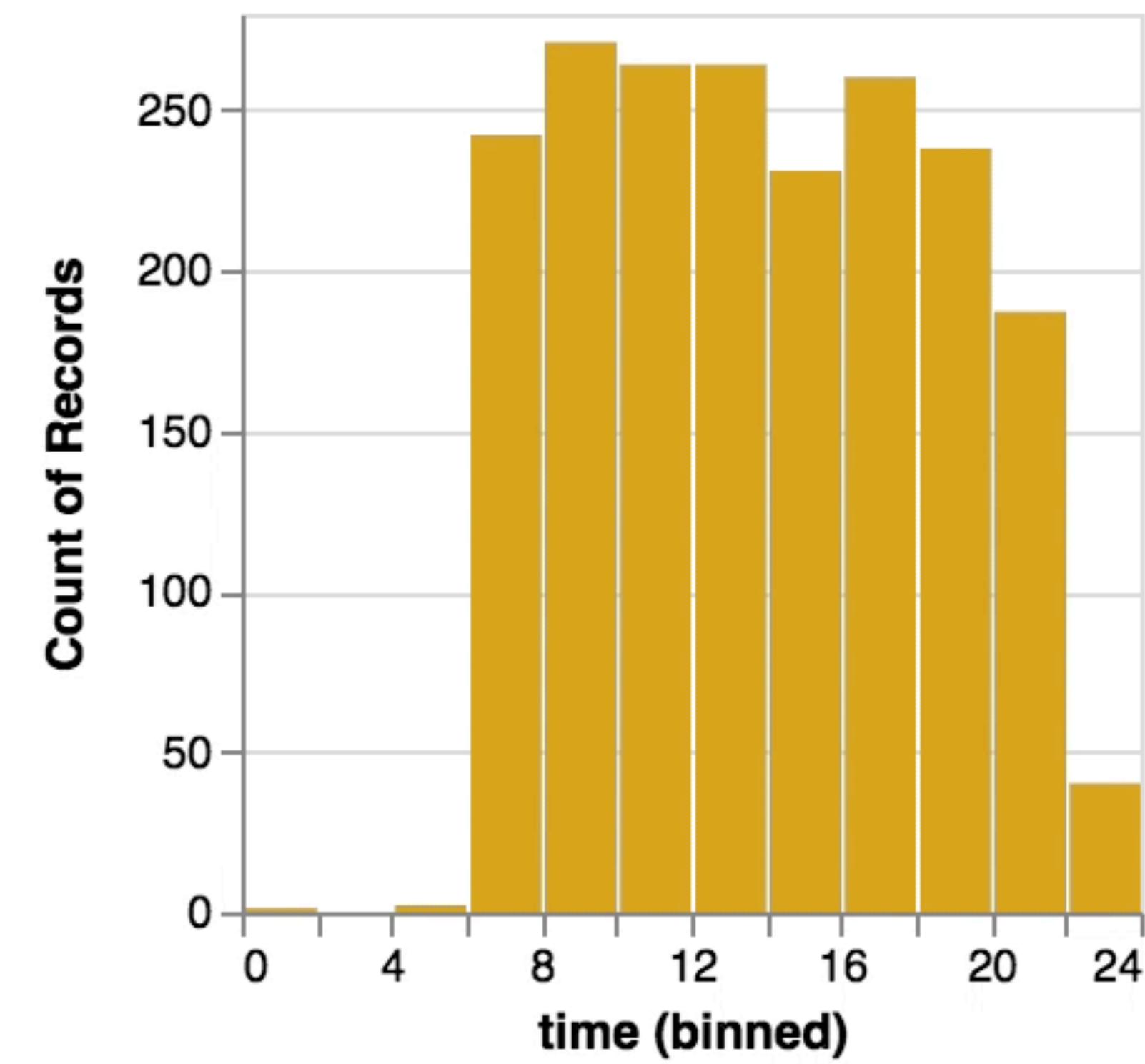
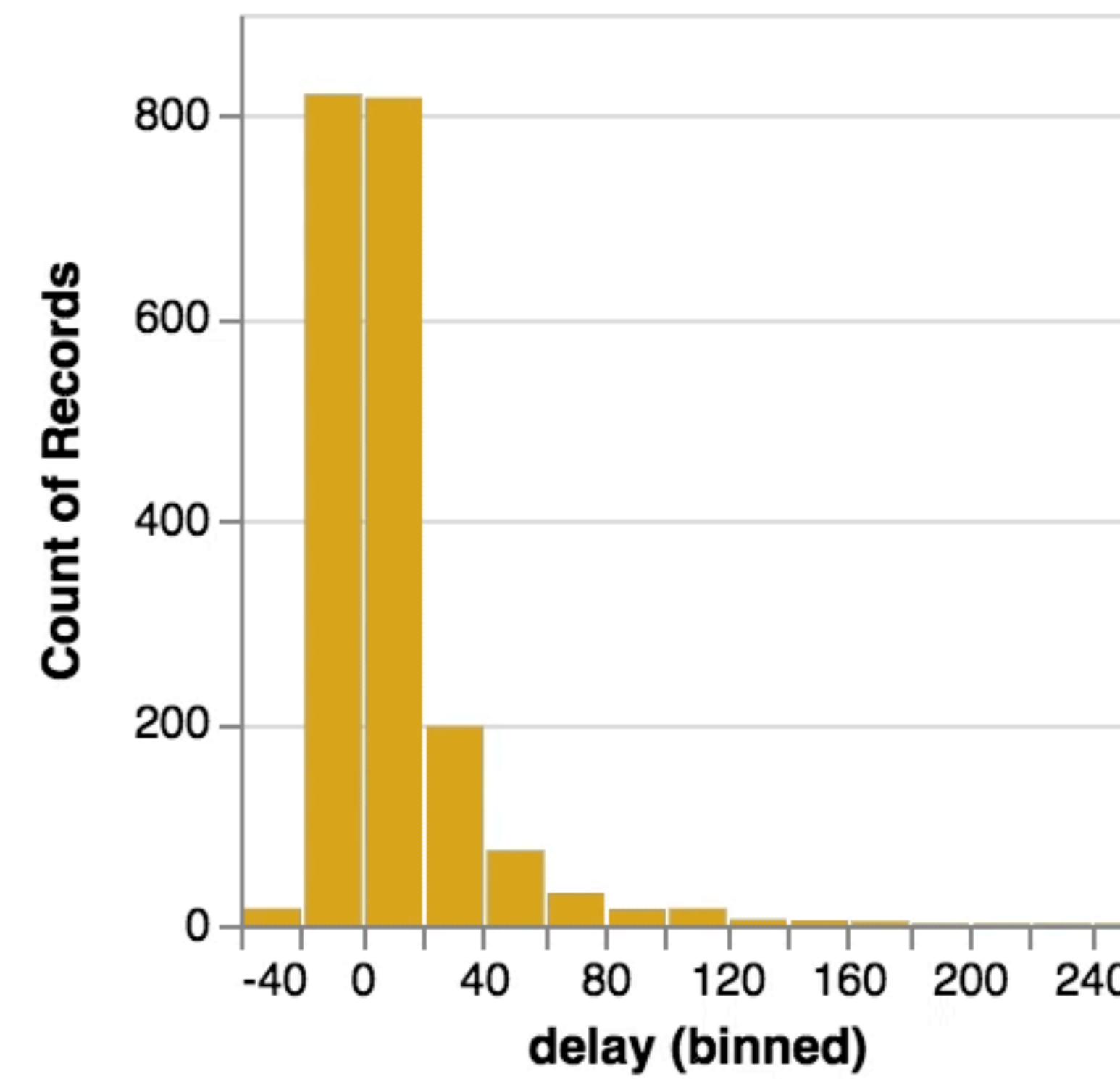
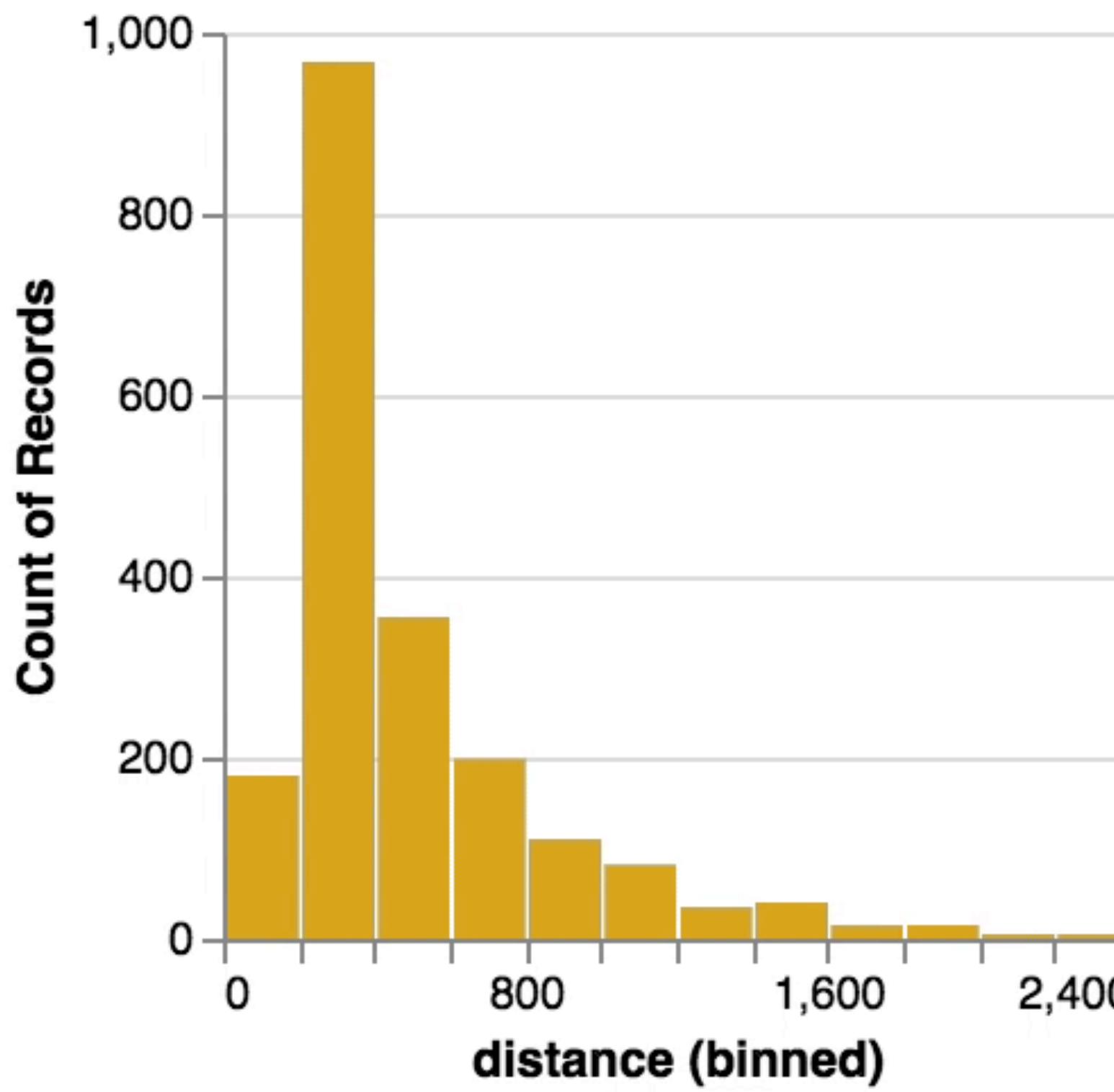
Brushing & linking:
selection = "brush",
selected data "linked" in
other views.



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!

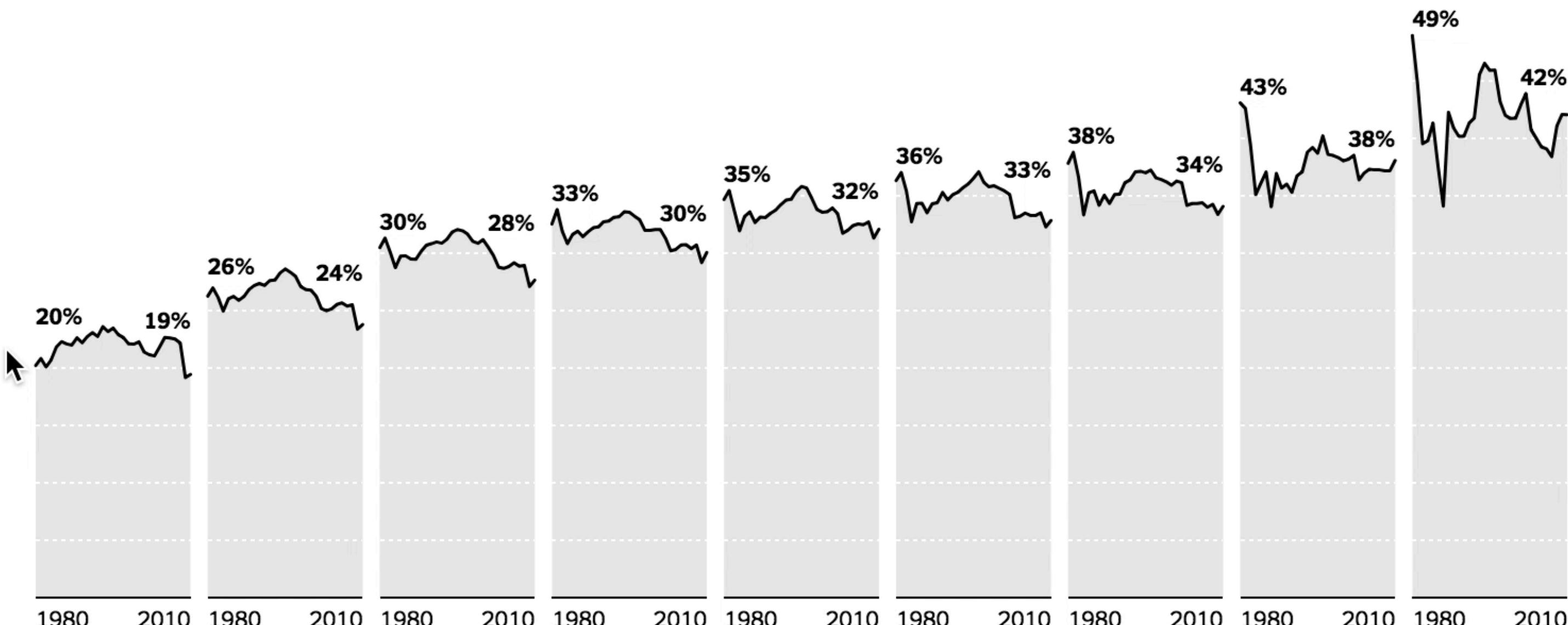
How the Tax Burden Has Changed

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.



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.

Interaction in Visualization

Select identify something as interesting.

Connect show me something conditionally.

Abstract/Elaborate show me related items.

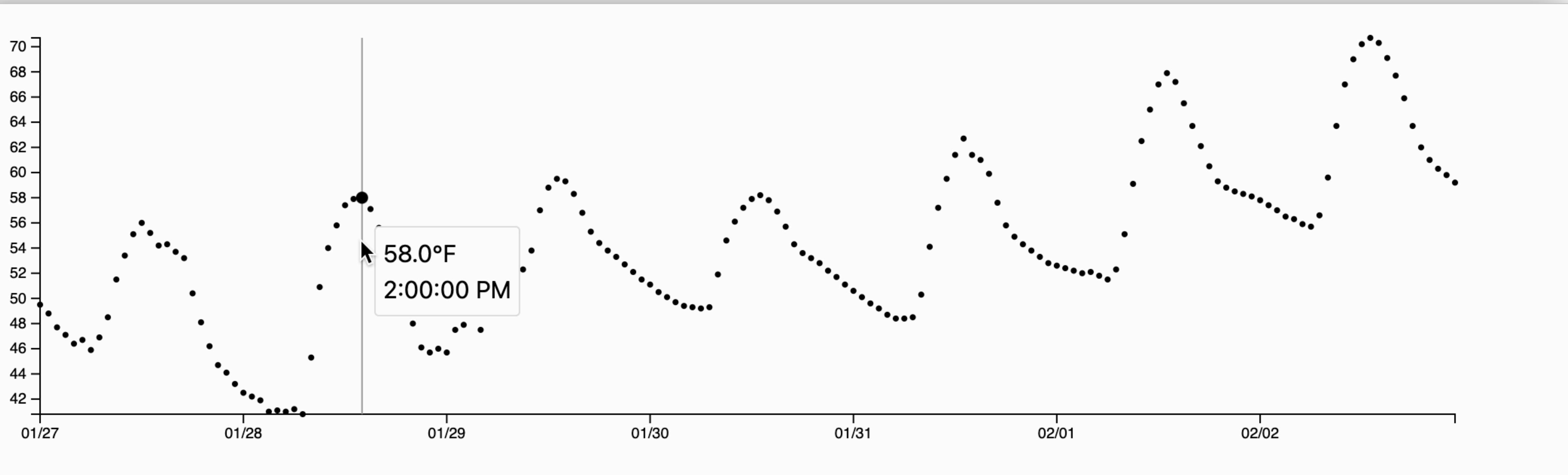
Filter show me more or less detail.

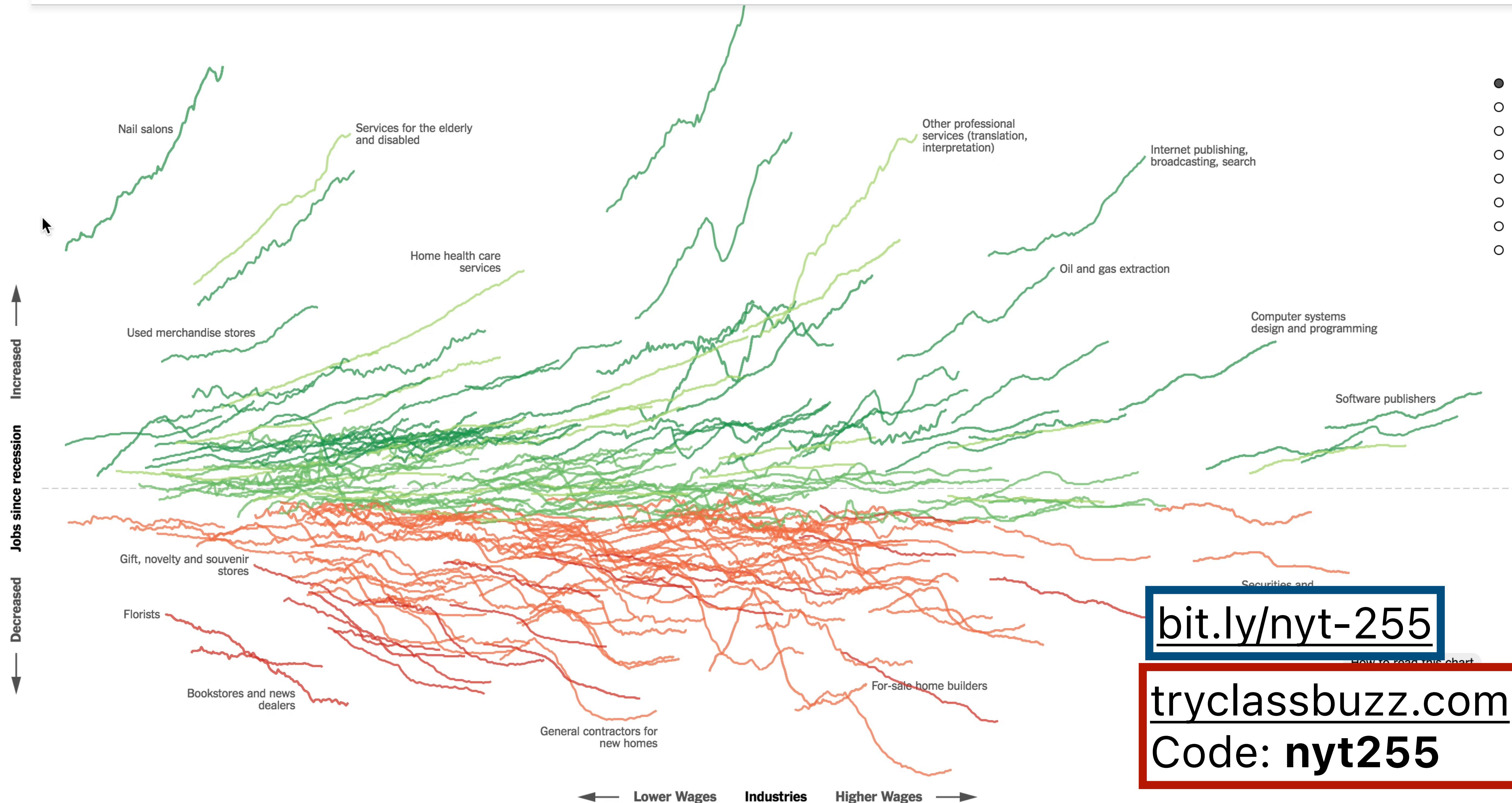
Reconfigure show me a different arrangement.

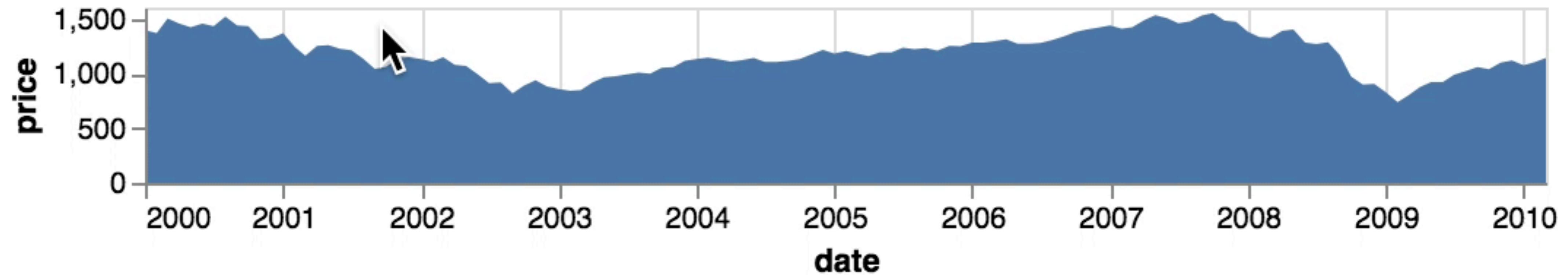
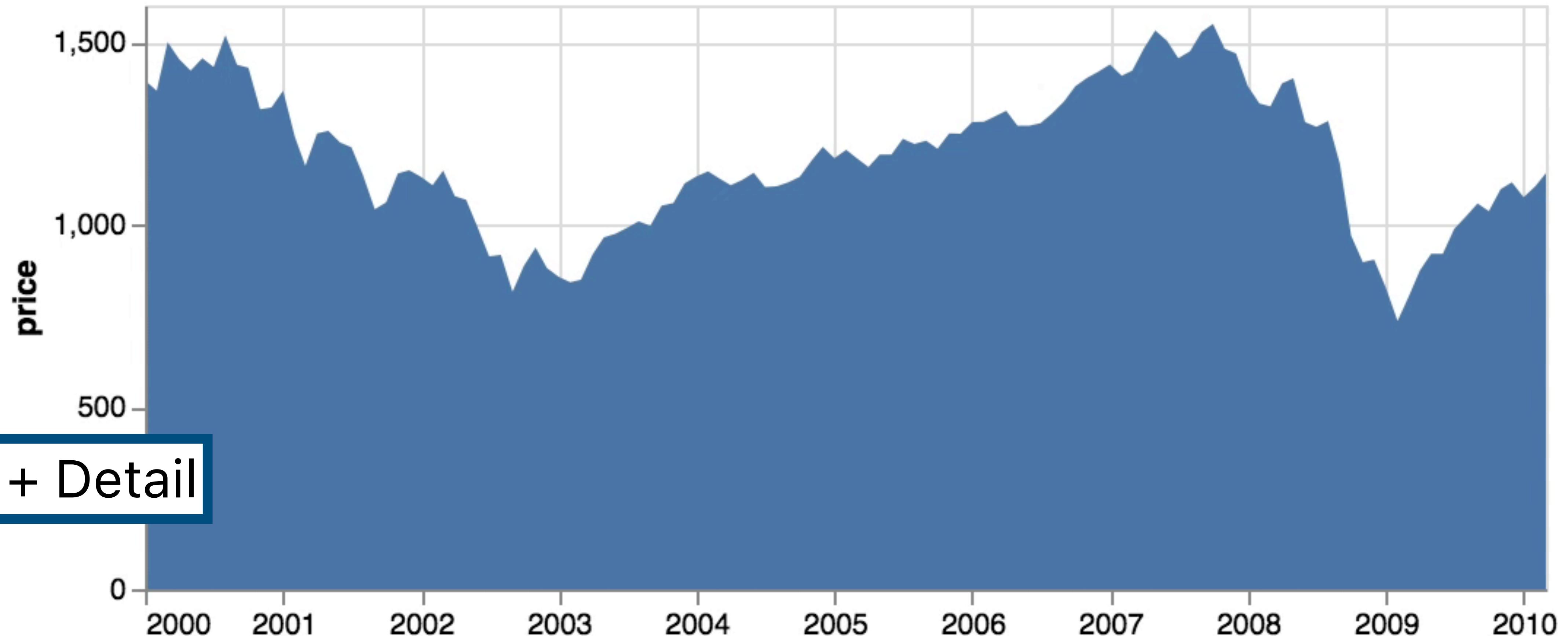
Explore show me something else.

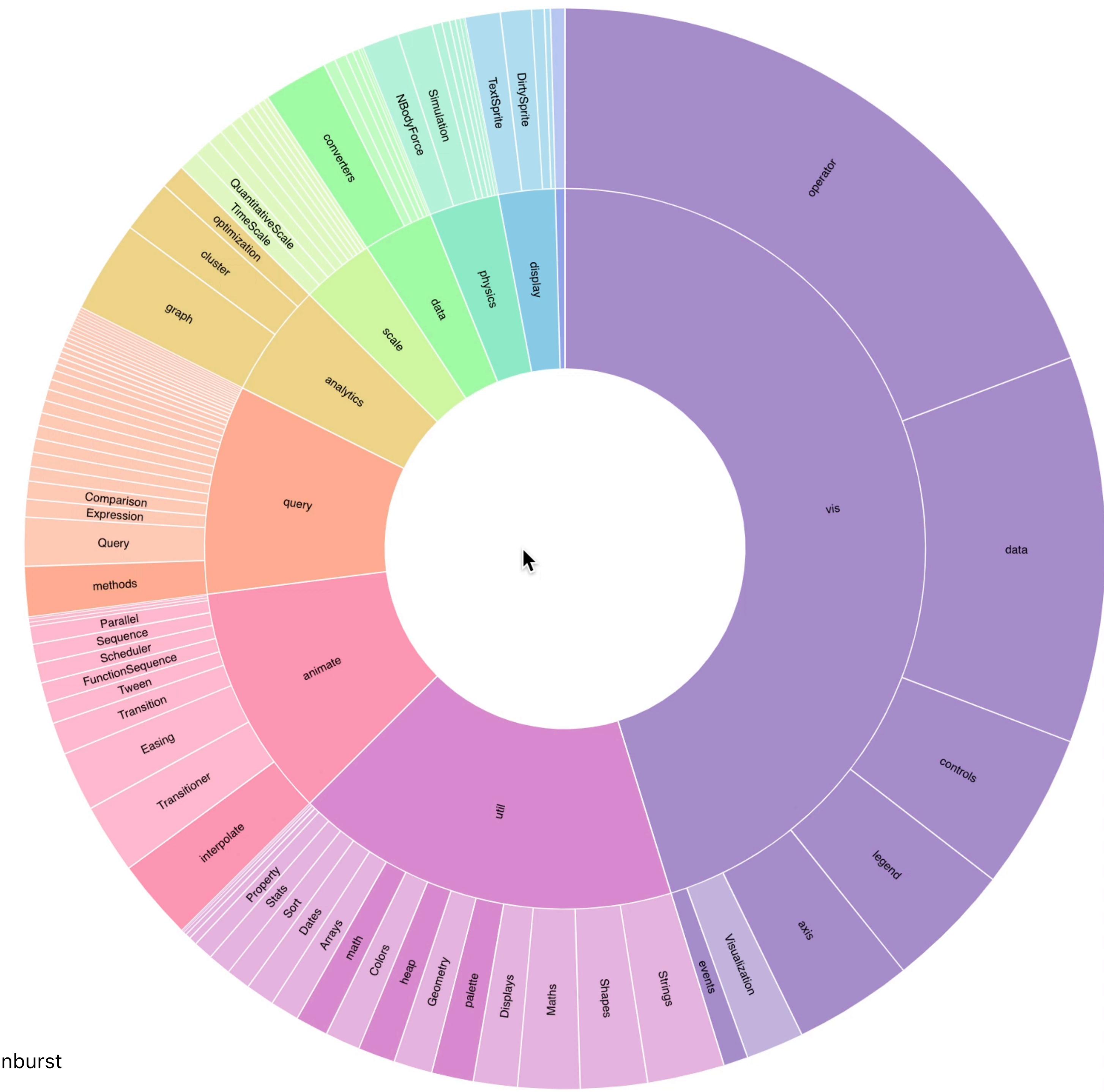
Encode show me a different visual representation.

Elaborate









Interaction in Visualization

Select identify something as interesting.

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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.

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.

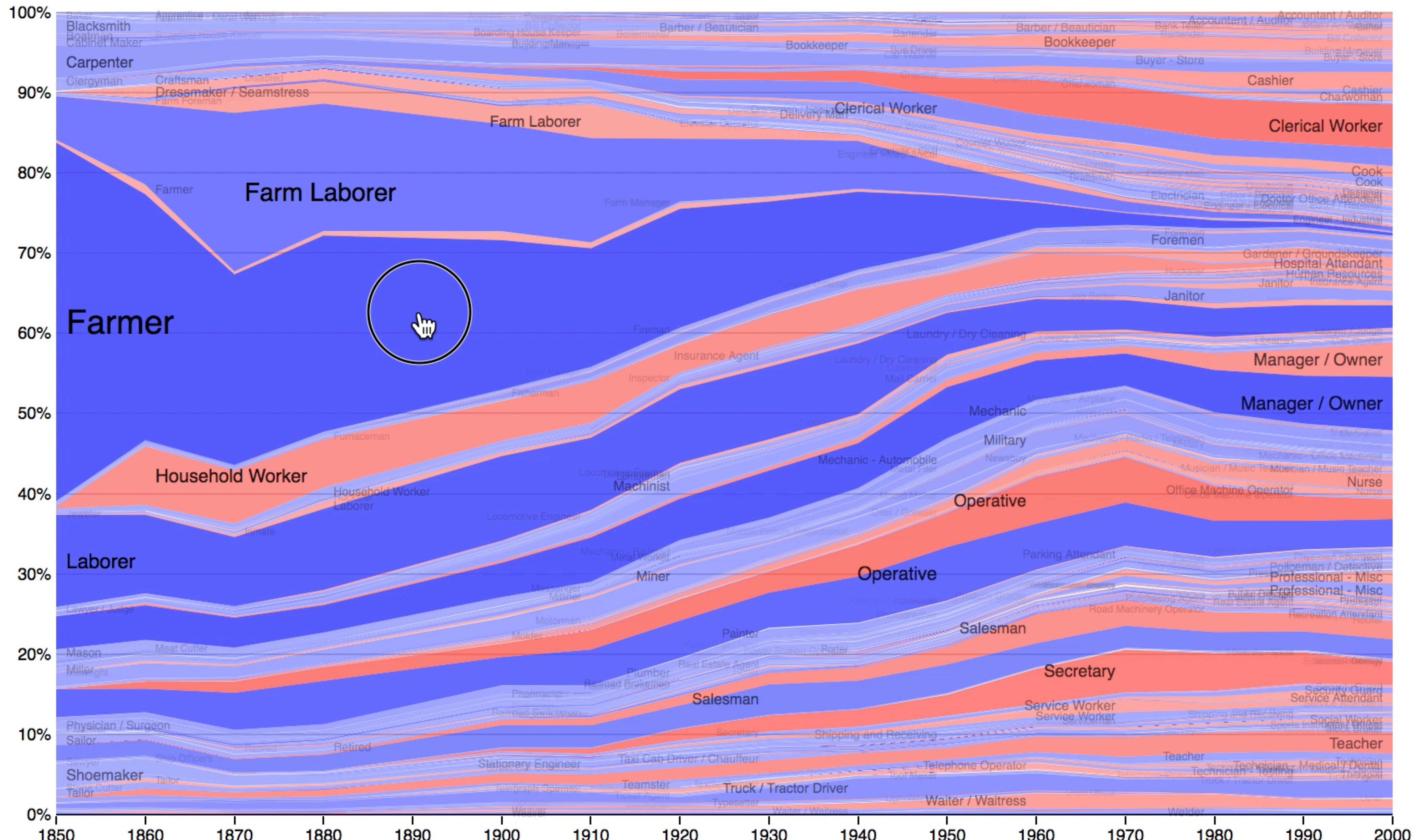
Reconfigure show me a different arrangement.

Explore show me something else.

Encode show me a different visual representation.

Job Voyager

Gender: Men Women Any



search: |

type the digits of a zip code

benfry.com/zipdecode/

tryclassbuzz.com
Code: zip

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.

Interaction in Visualization

Select identify something as interesting.

Connect show me something conditionally.

Abstract/Elaborate show me related items.

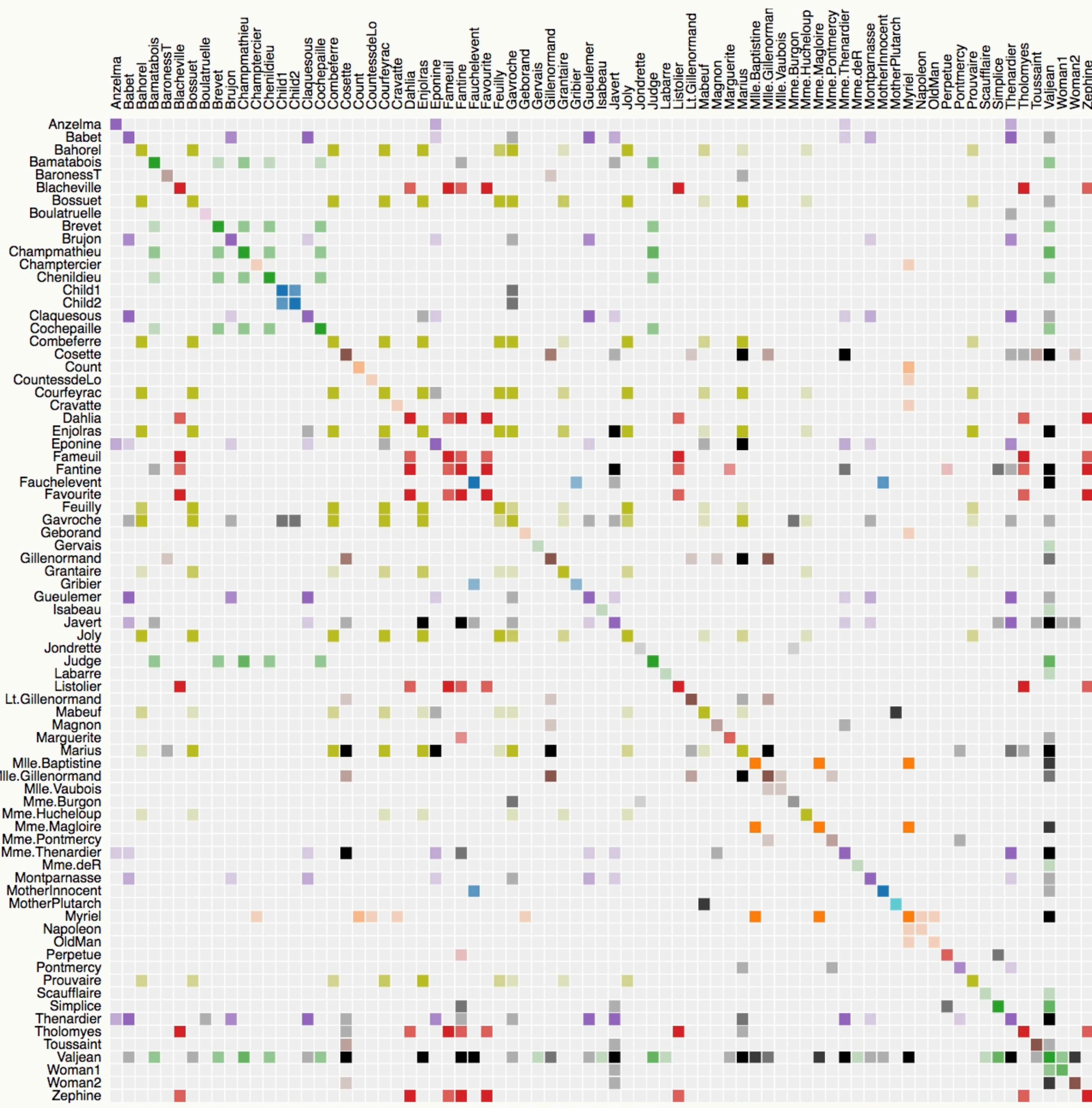
Filter show me more or less detail.

Reconfigure show me a different arrangement.

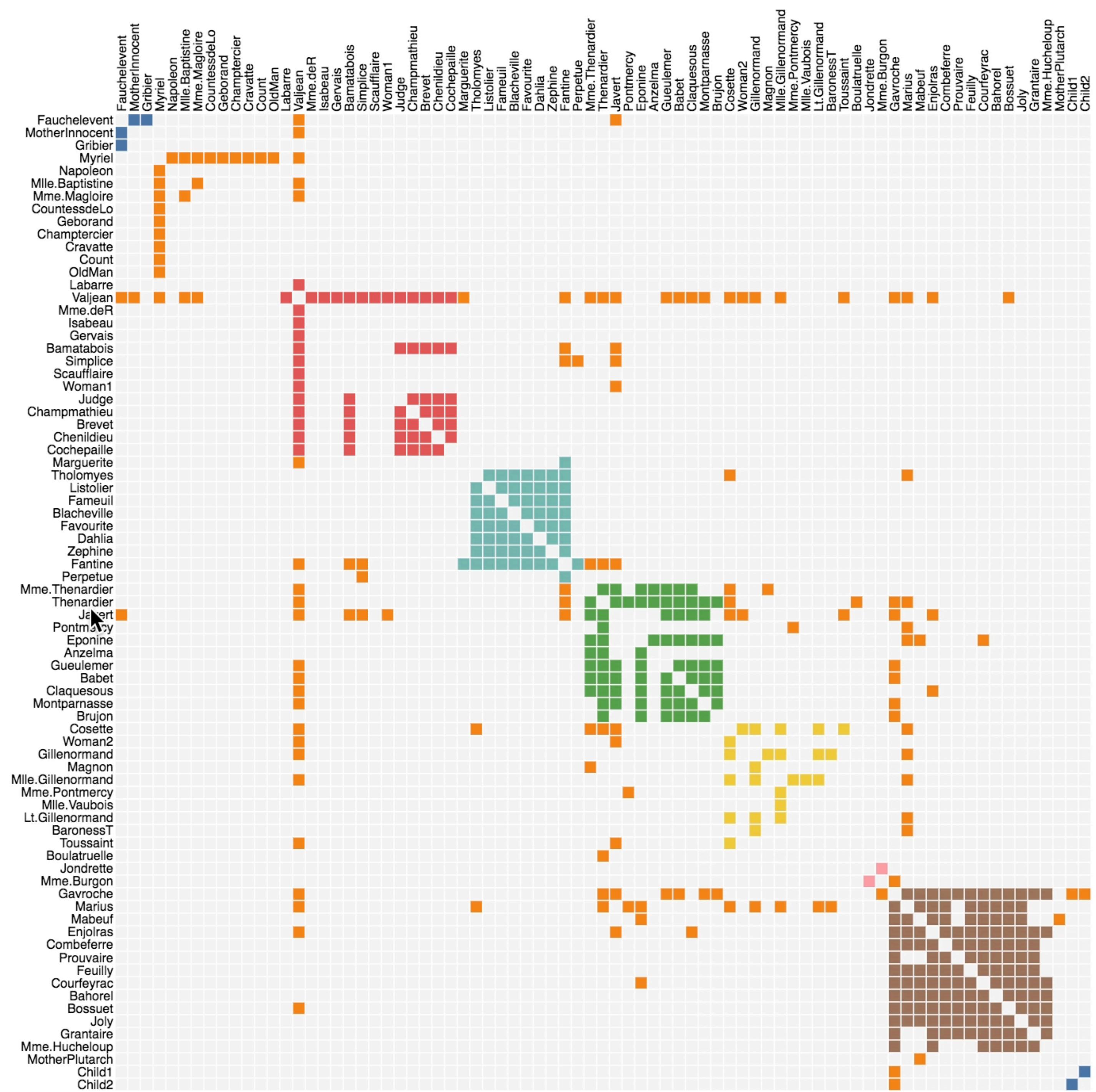
Explore show me something else.

Encode show me a different visual representation.

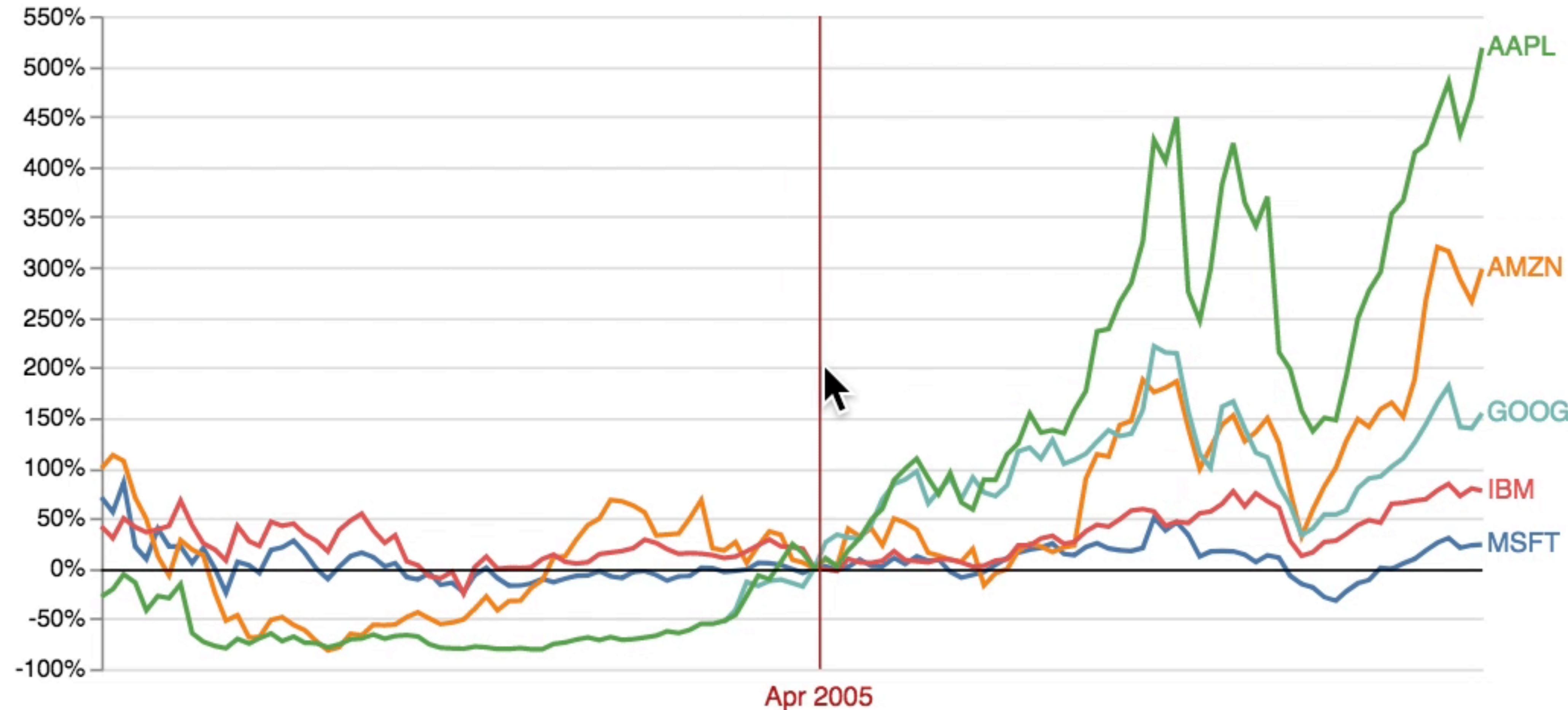
Reconfigure



Reconfigure



Reconfigure



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.

Interaction in Visualization

Select identify something as interesting.

Connect show me something conditionally.

Abstract/Elaborate show me related items.

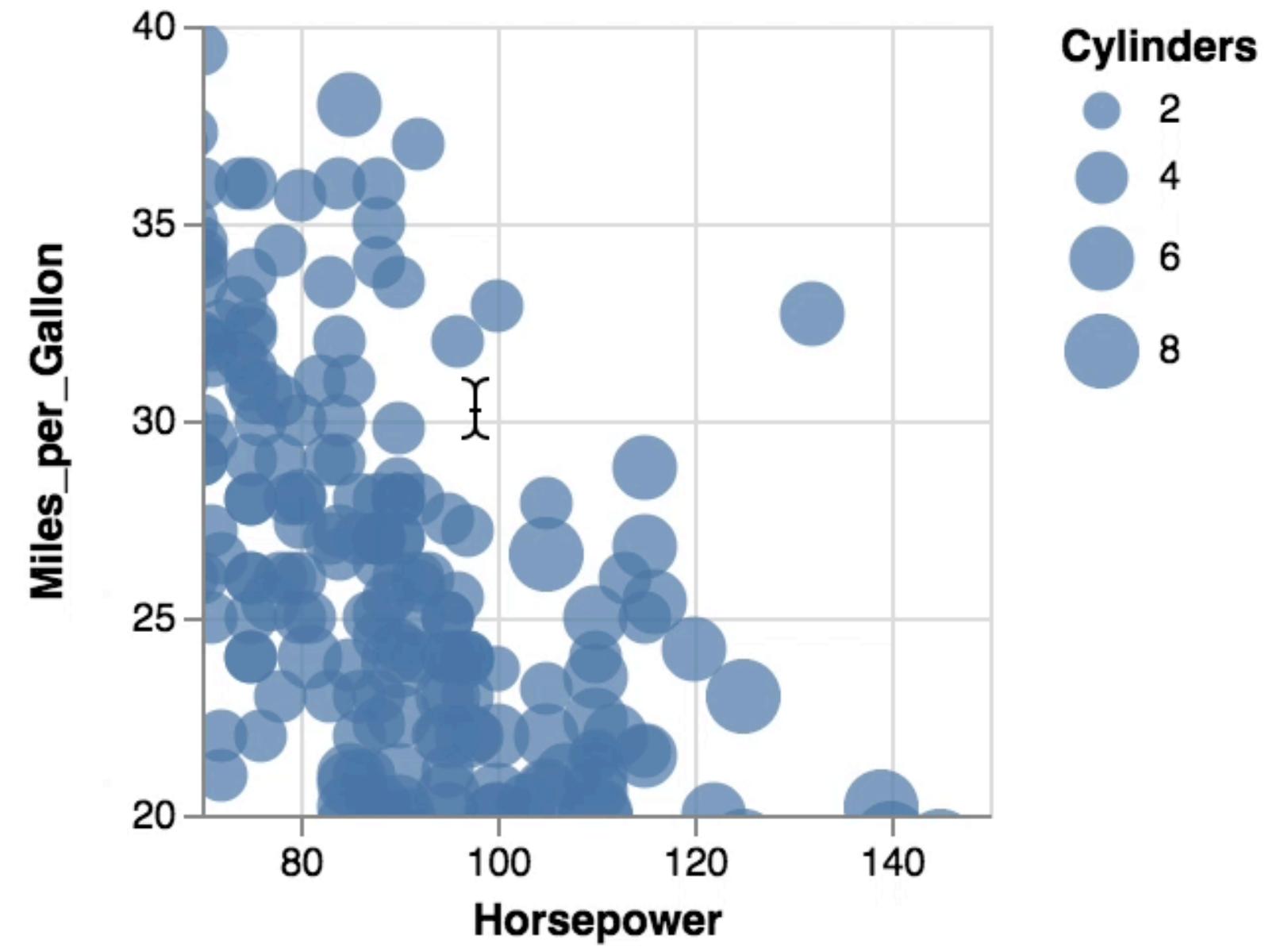
Filter show me more or less detail.

Reconfigure show me a different arrangement.

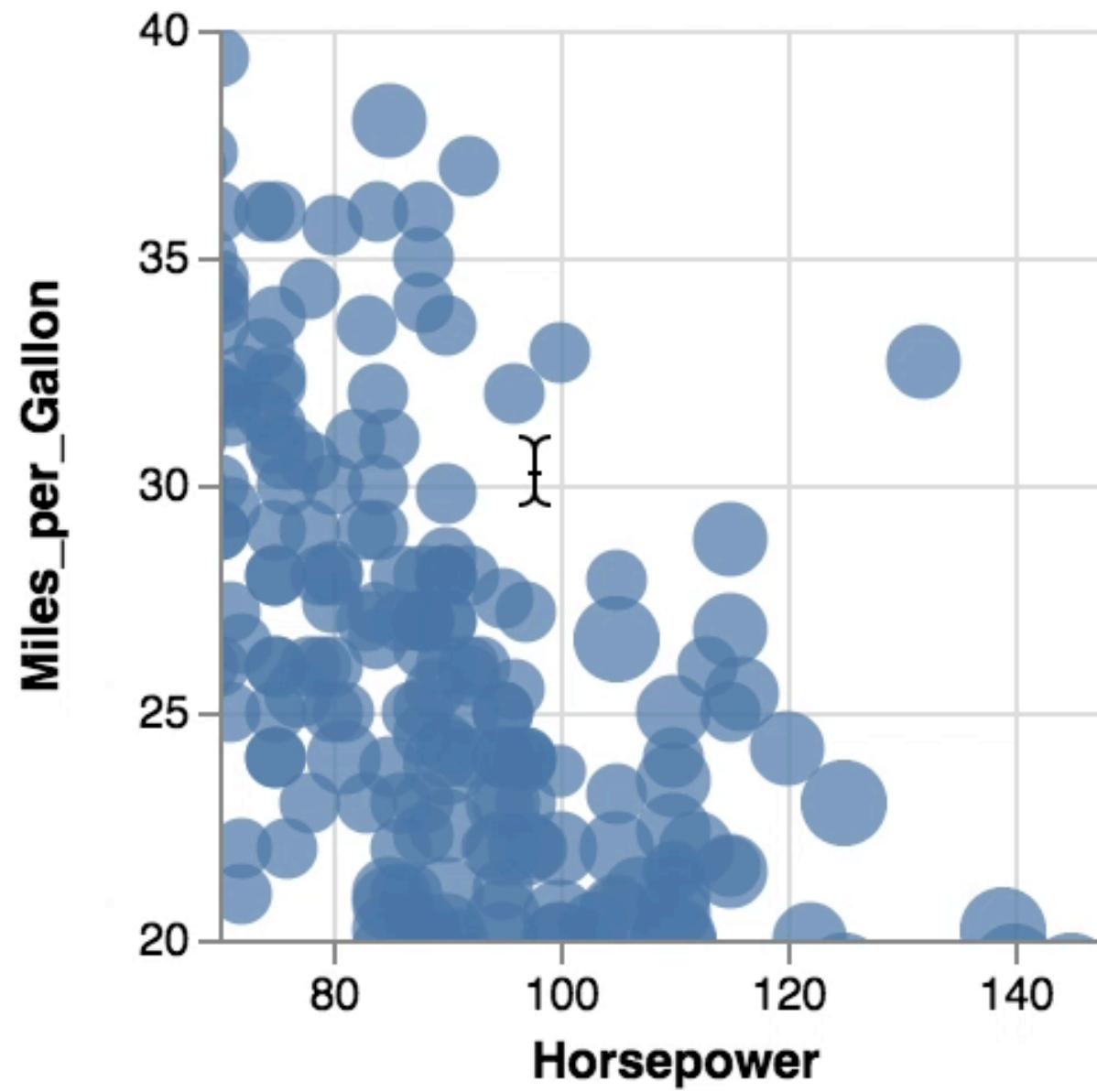
Explore show me something else.

Encode show me a different visual representation.

Explore

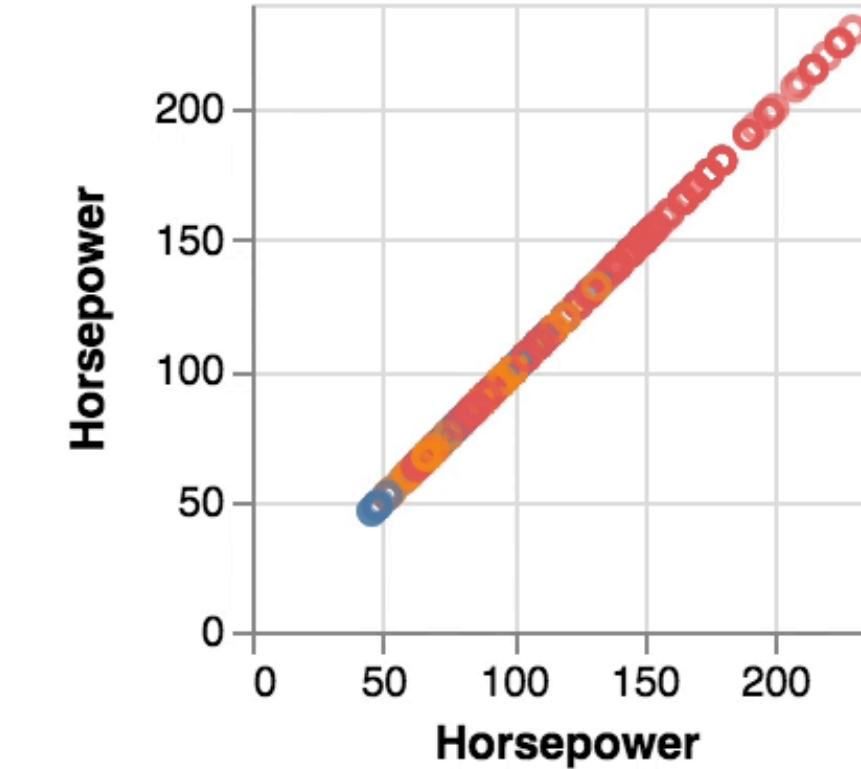
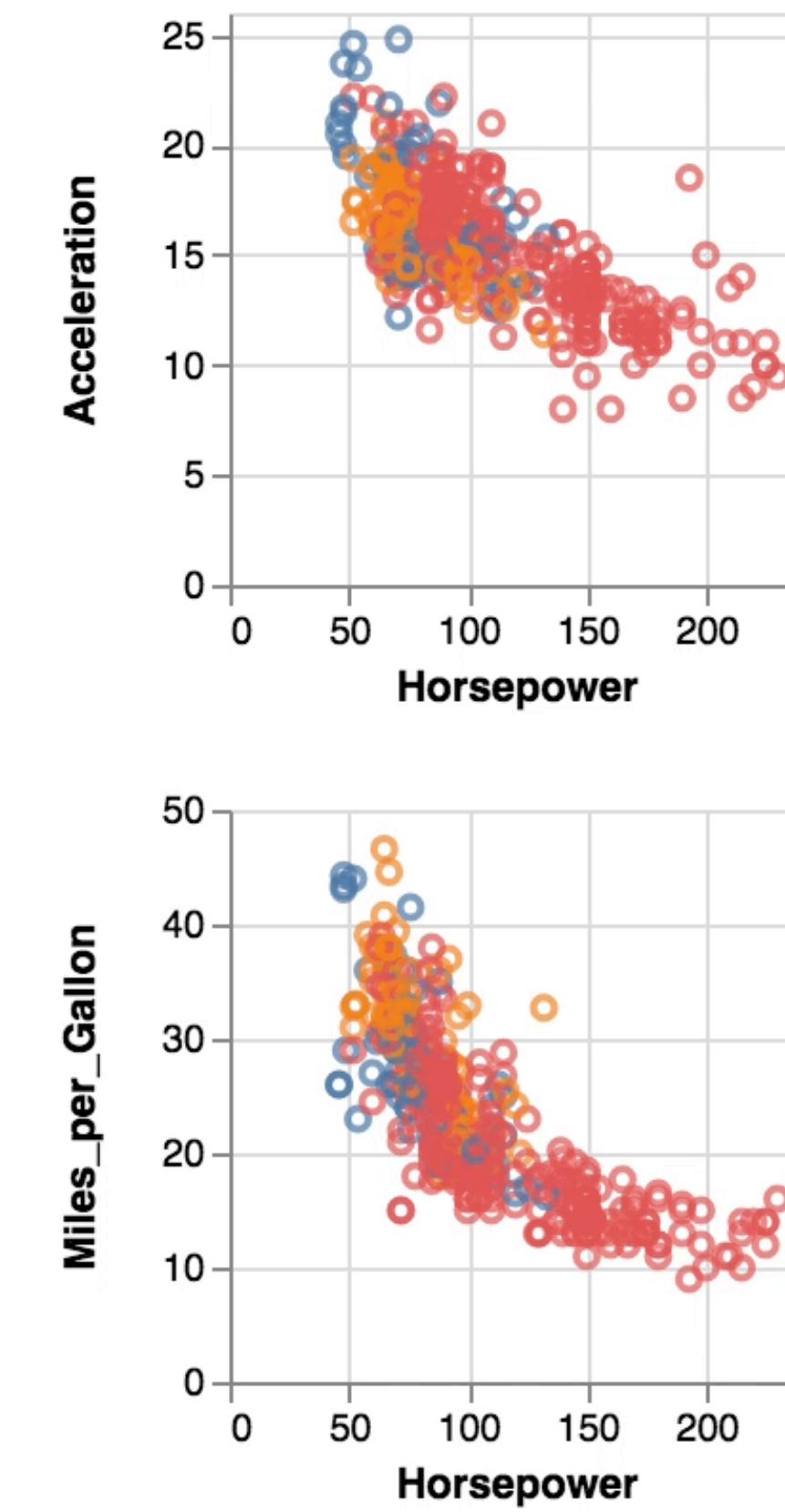
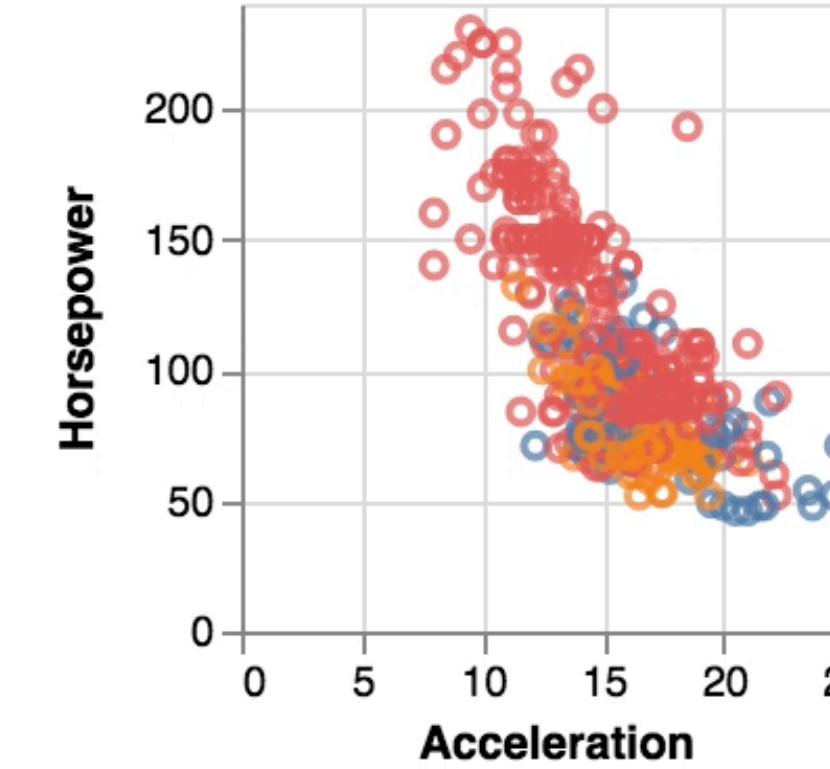
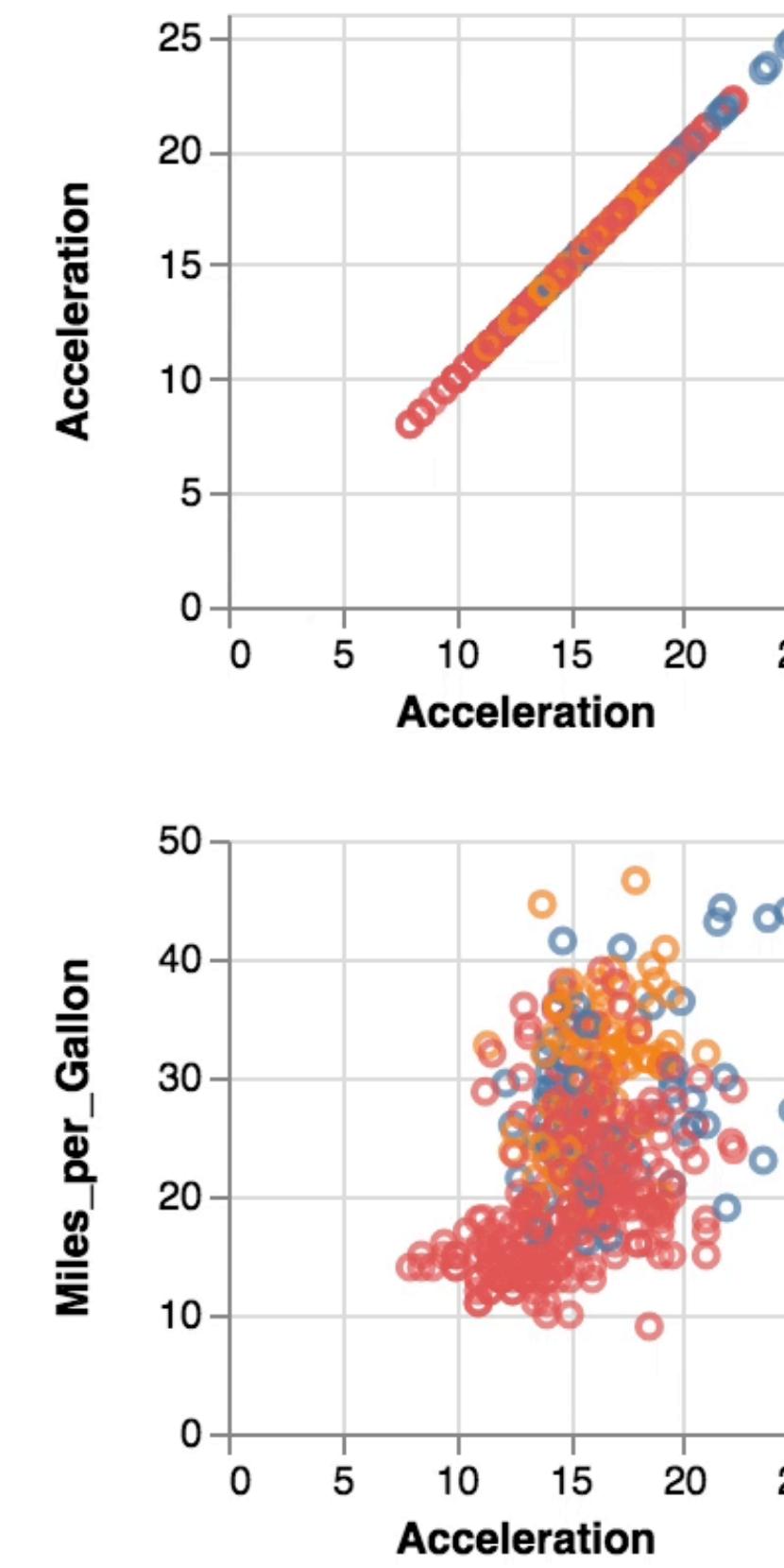
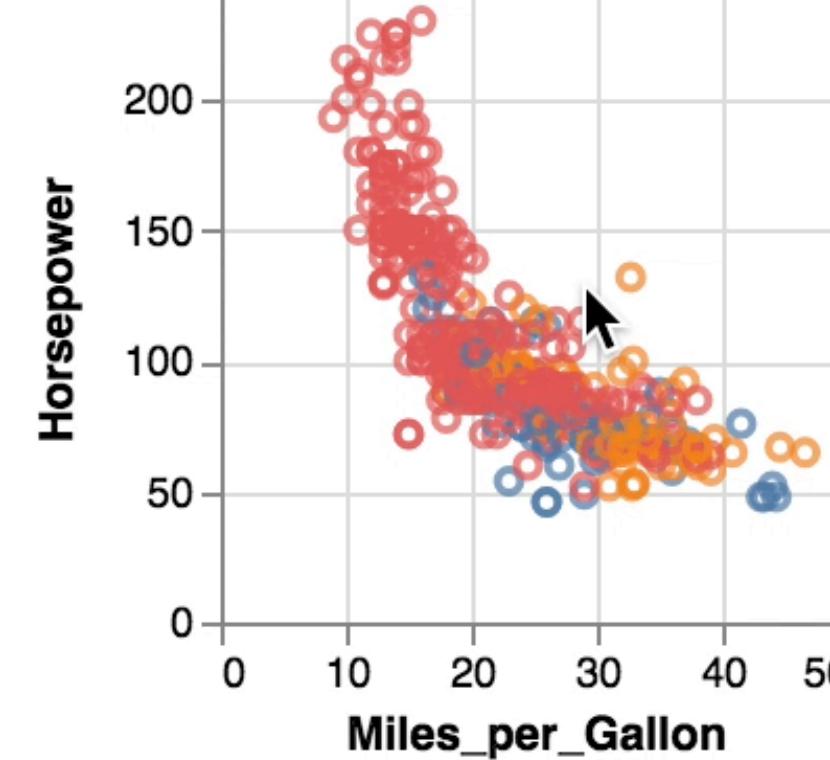
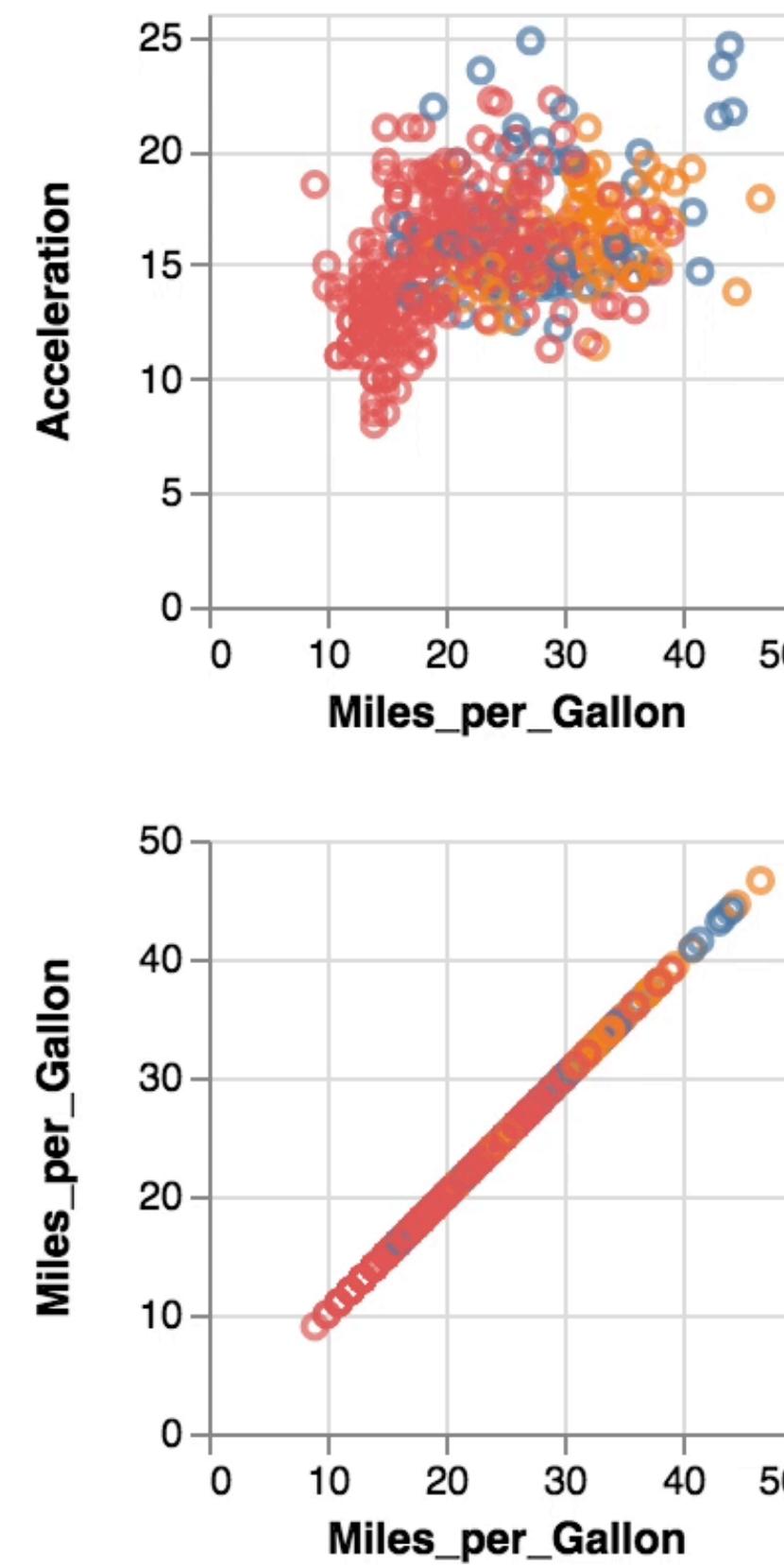


Explore



Cylinders

- 2
- 4
- 6
- 8



Origin

- Europe
- Japan
- USA

Explore

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



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

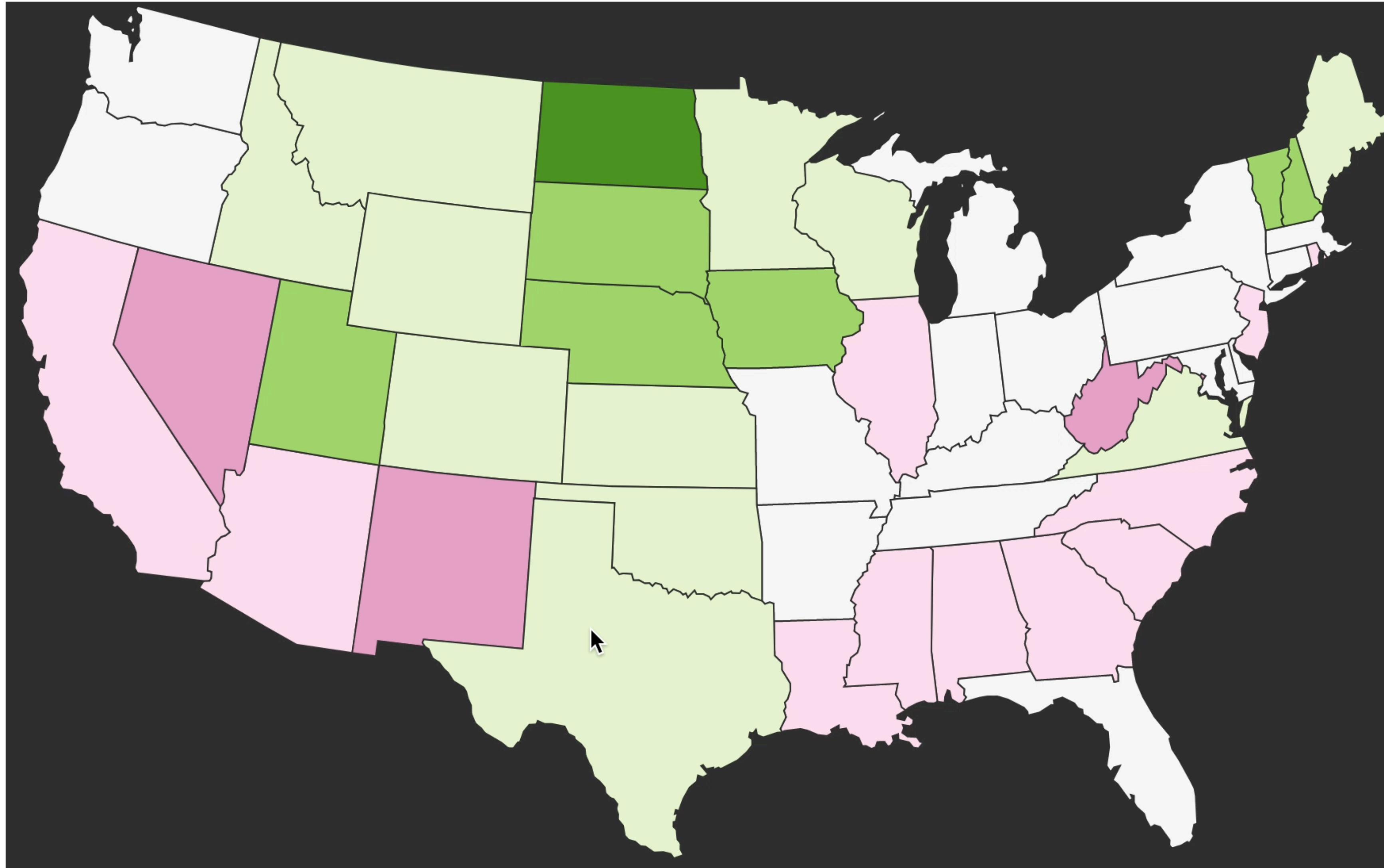
Explore

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



Explore

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



[https://bl.ocks.org/cmgiven/
d39ec773c4f063a463137748097ff52f](https://bl.ocks.org/cmgiven/d39ec773c4f063a463137748097ff52f)

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.

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.

See interactive systems like Tableau / Voyager

Encode show me a different visual representation.

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 way.

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