

# Lecture 10: Interaction and Faceting

DS 4200  
SPRING 2023

Prof. Ab Mosca (*they/them*)  
NORTHEASTERN UNIVERSITY

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

# Last Class

**We:**

- Looked at the “Arrange” step of table visual encodings

**Any Questions?**

# Today

- Review Interaction
- Review Faceting

# INTERACTION

# Interaction

## Benefits of Interaction

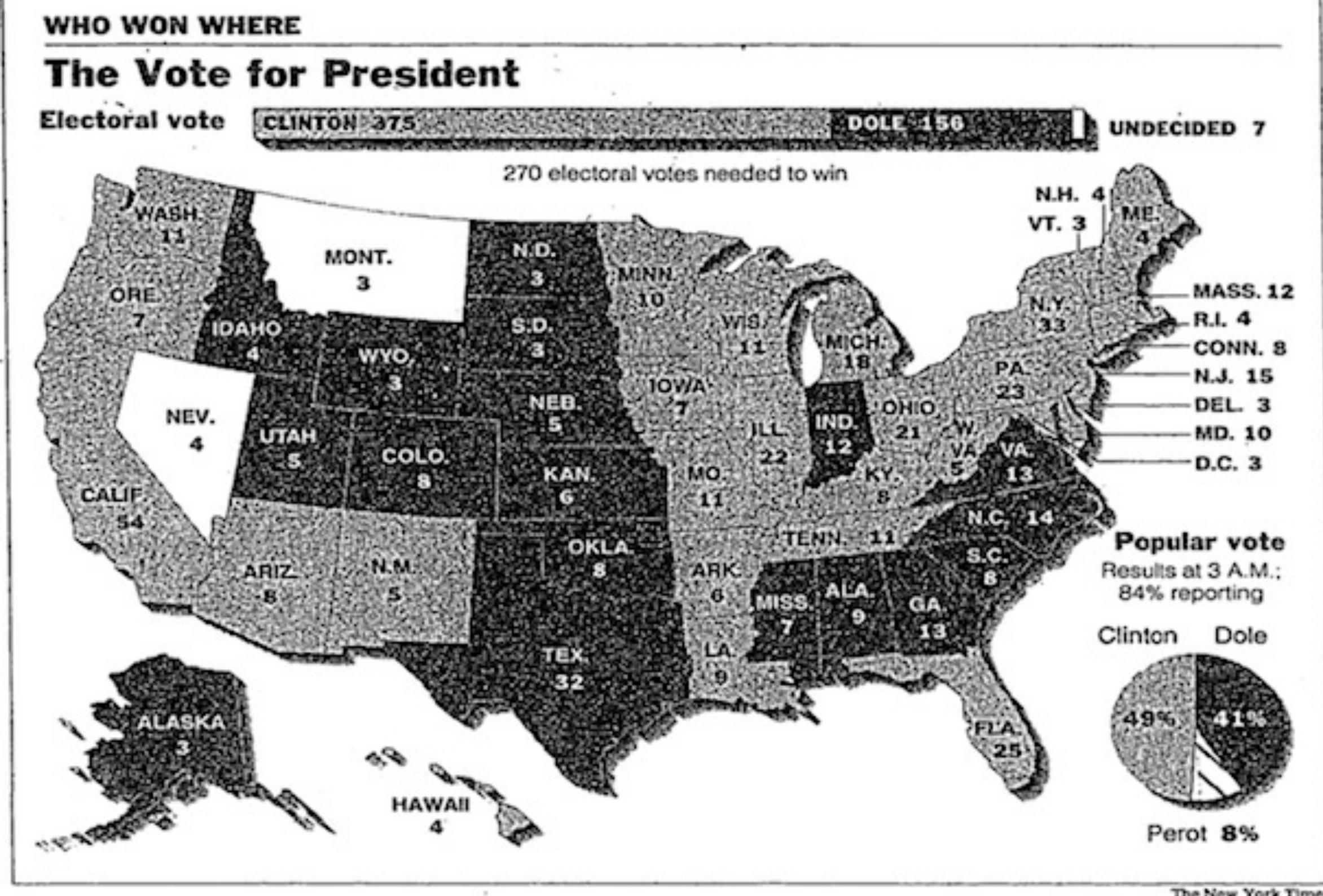
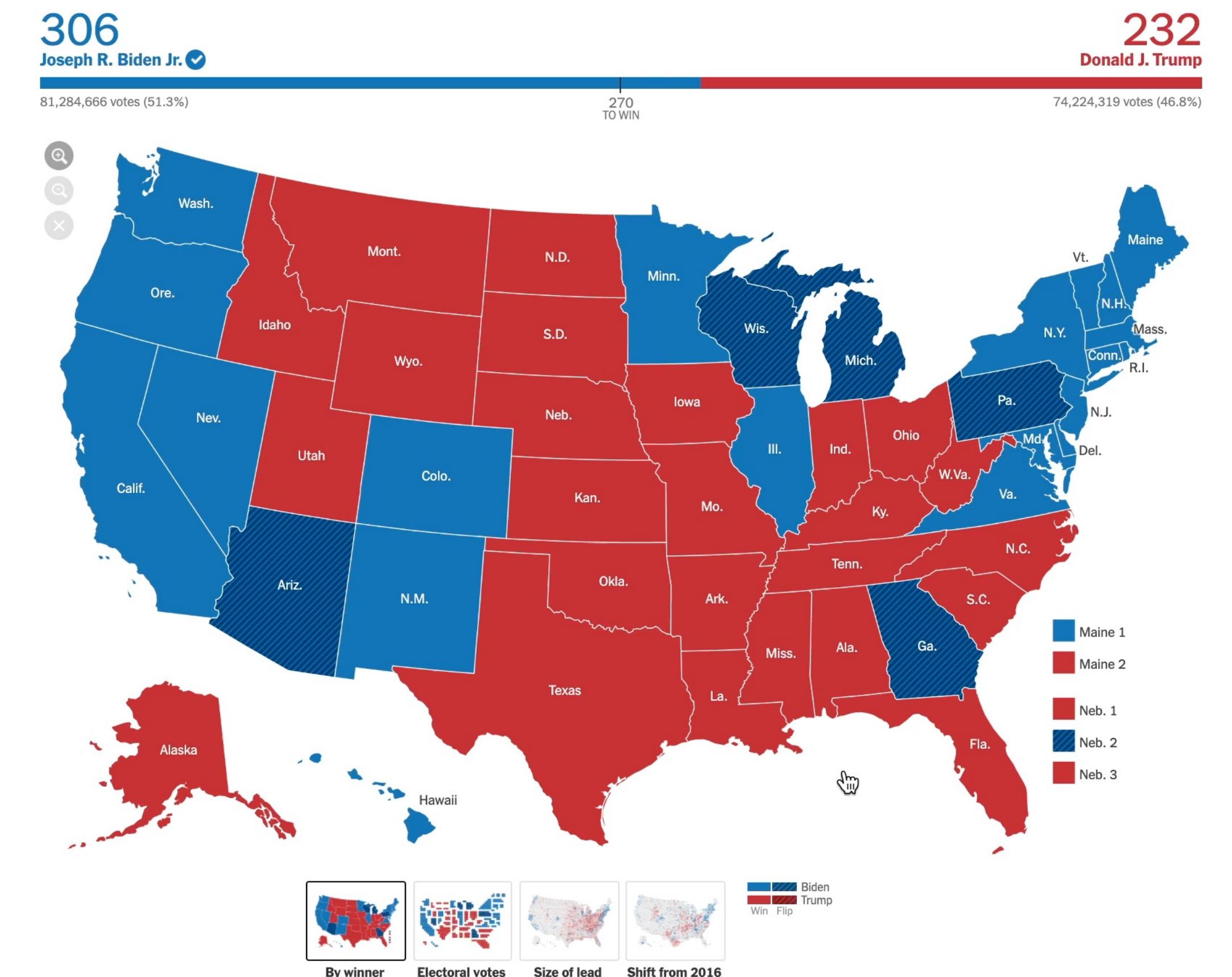
- Enables visualization of large amounts of data
- Amplifies user cognition (supports sensemaking)
- Increases engagement (vis becomes personal to user)
- Increases deep learning and learning transfer

# Interaction

**1996 → 2020**

## Presidential Election Results: Biden Wins

Joseph R. Biden Jr. was elected the 46th president of the United States. Mr. Biden defeated President Trump after winning Pennsylvania, which put his total of Electoral College votes above the 270 he needed to clinch the presidency.



<https://www.theatlantic.com/technology/archive/2012/11/116-years-of-electoral-infographics-from-the-new-york-times/264692/>

<https://www.nytimes.com/interactive/2020/11/03/us/elections/results-president.html>

# Interaction

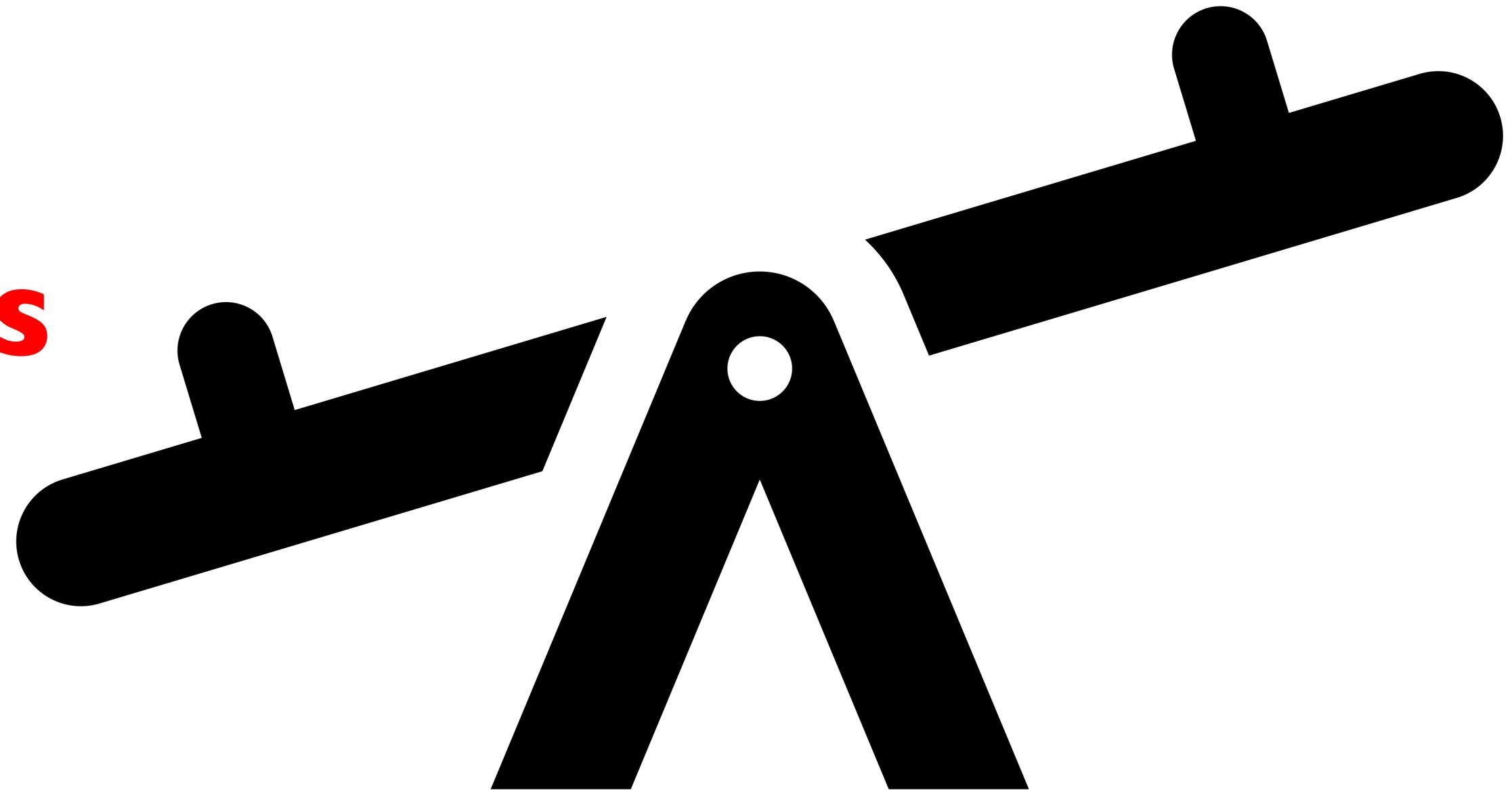
## Caveats of Interaction

- Requires human time and attention
- Increase perceptual and exploration costs (van Wijk 2005)
- Interaction costs (Lam 2008)
- Multiple user studies find no increase in performance  
(Theis et al. 2016, Ragan et al. 2012, Mosca et al. 2021)

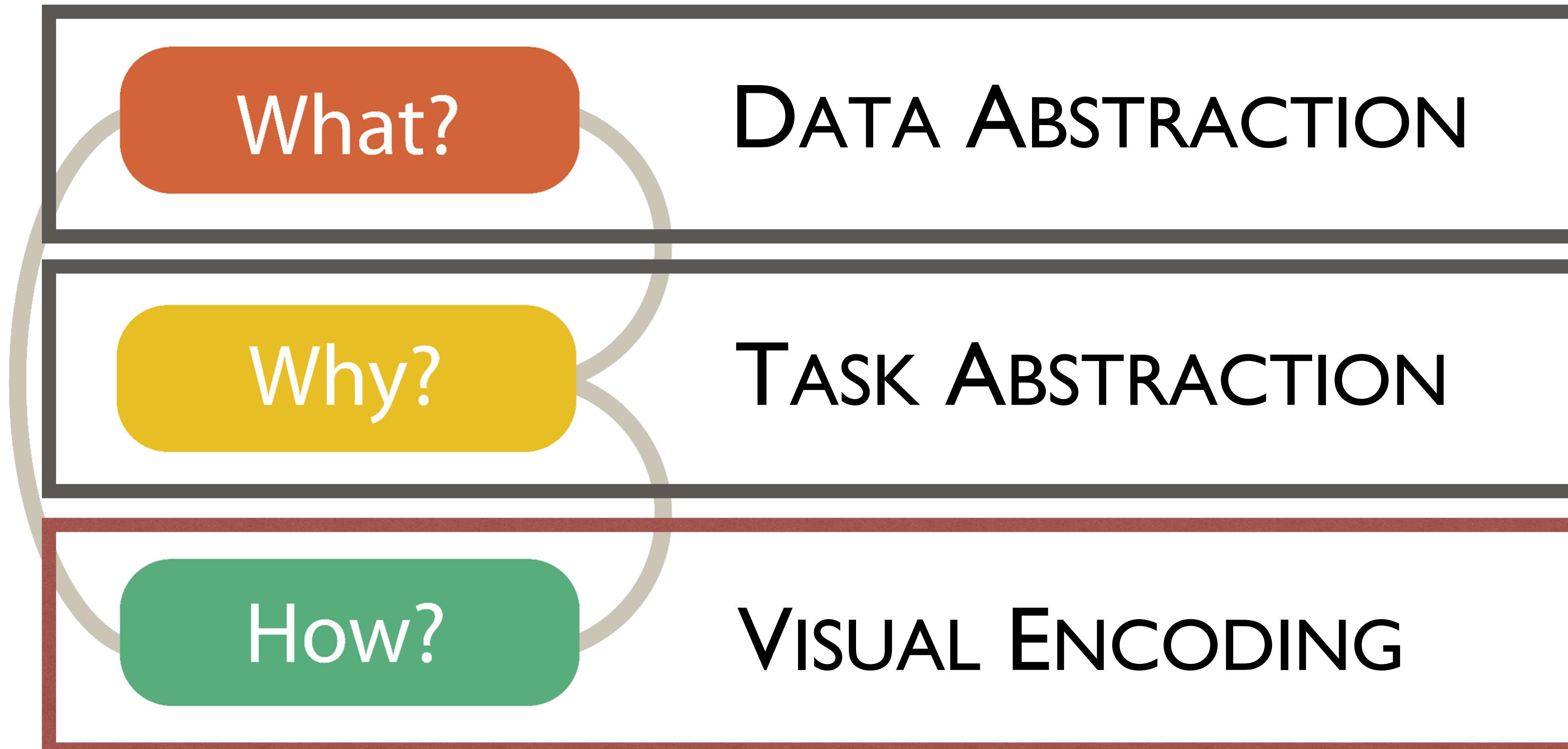
# Interaction

**Costs**

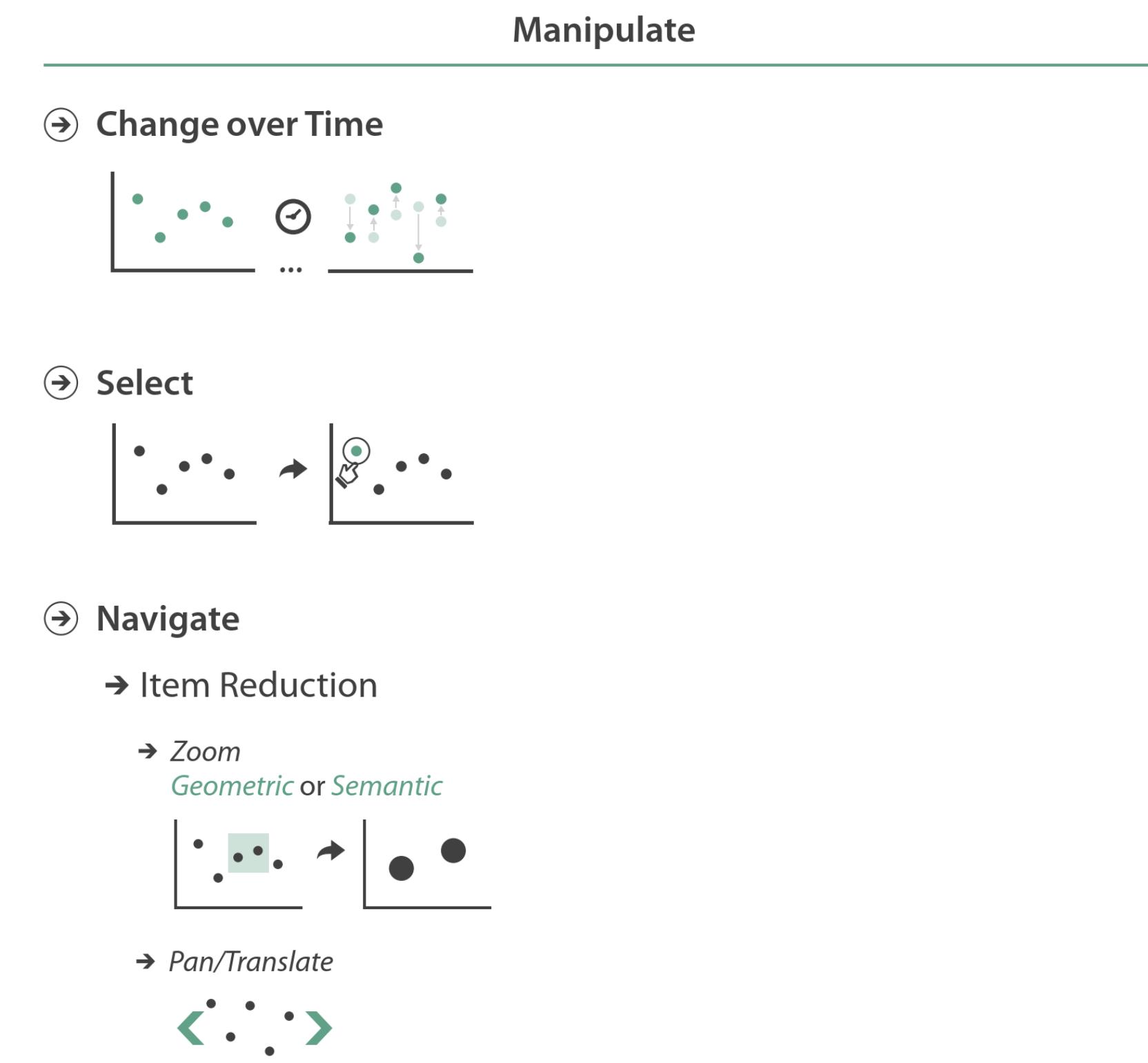
**Benefits**



# Visualization Building Blocks



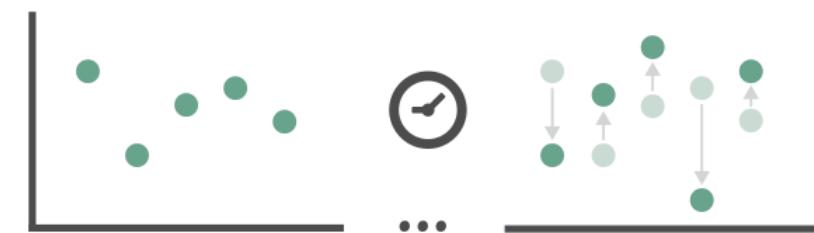
# Interaction Taxonomies: Munzner



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## Change over time

→ Change over Time



Example: D3  
Animated  
Transitions

flexible transitions

<http://mbostock.github.io/d3/talk/20111116/#11>

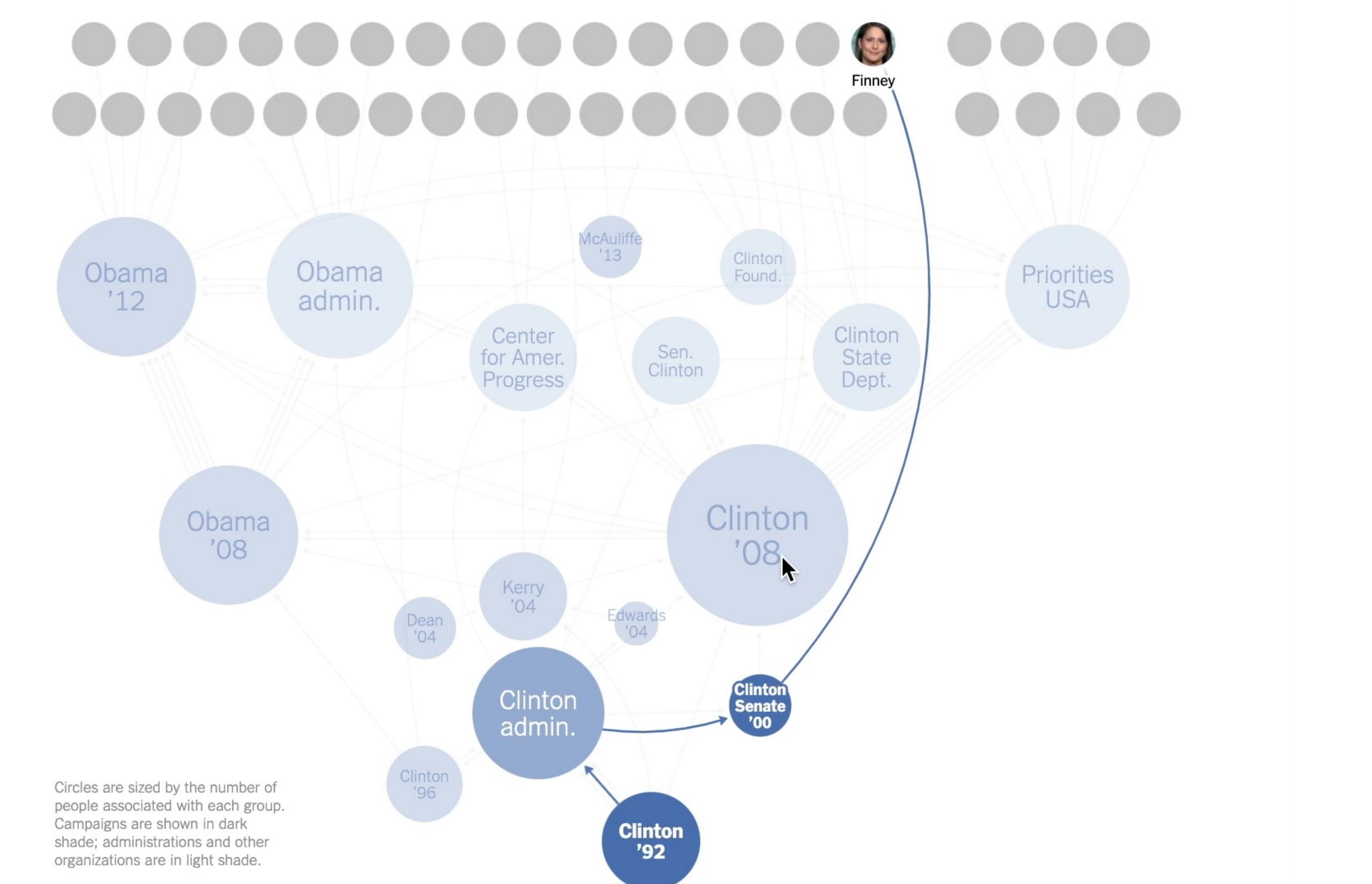
# Interaction Taxonomies: Munzner

## Selection

④ Select



Example: NYT  
Campaign  
Connections

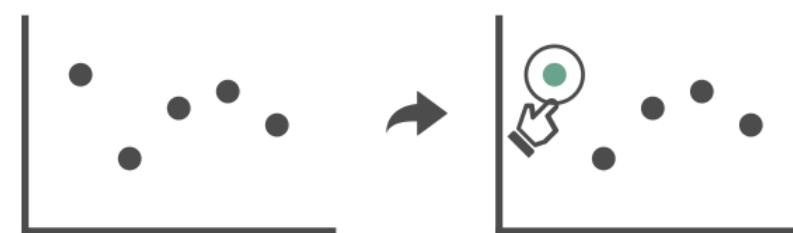


<http://www.nytimes.com/interactive/2015/05/17/us/elections/2016-presidential-campaigns-staff-connections-clinton-bush-cruz-paul-rubio-walker.html>

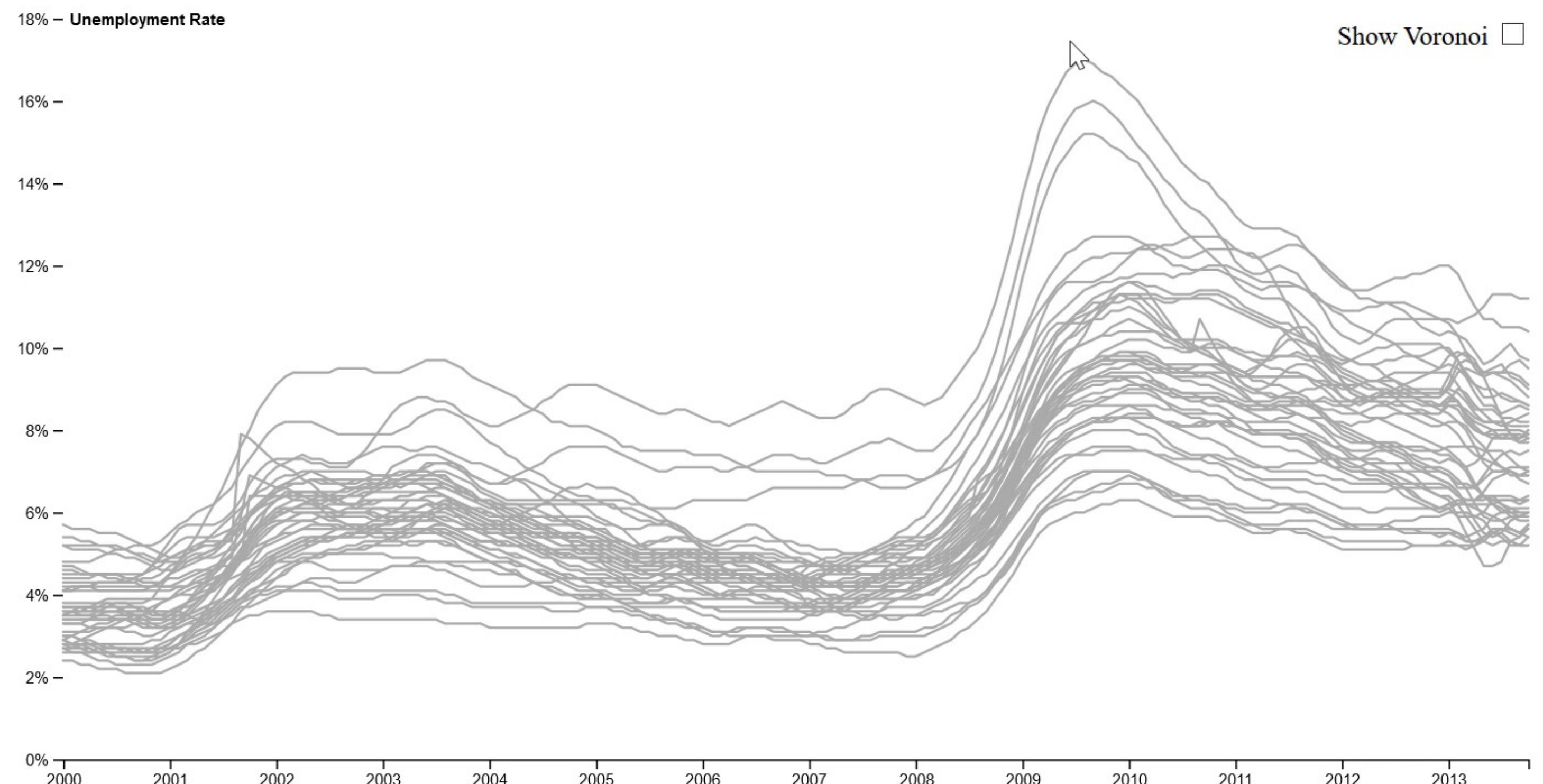
# Interaction Taxonomies: Munzner

## Selection

④ Select



Example:  
Voronoi  
Cursors



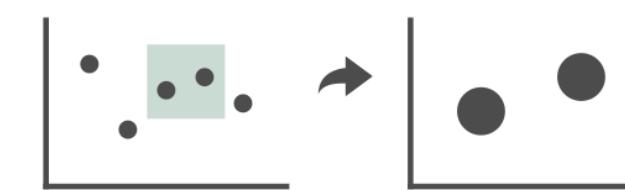
# Interaction Taxonomies: Munzner

## Navigate

### ④ Navigate

→ Item Reduction

→ Zoom  
Geometric or Semantic



→ Pan/Translate



### → Attribute Reduction

→ Slice



→ Cut



→ Project



**Attributes**

College	Major	Num Students
Khoury	Computer Science	300
Khoury	Data Science	475
Khoury	Math	699
COS	Math	80
COS	Data Science	402
D'Amore-McKim	Computer Science	337
D'Amore-McKim	Data Science	920

**Items**

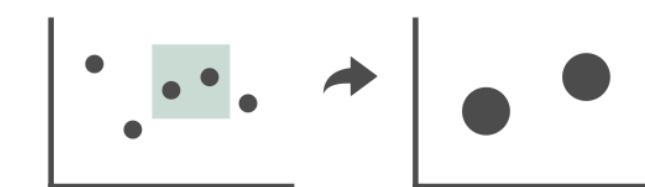
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## Navigate

### ④ Navigate

#### → Item Reduction

→ Zoom  
Geometric or Semantic



#### → Pan/Translate

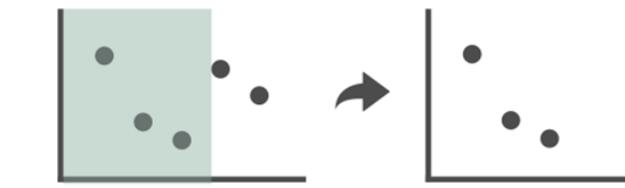


#### → Attribute Reduction

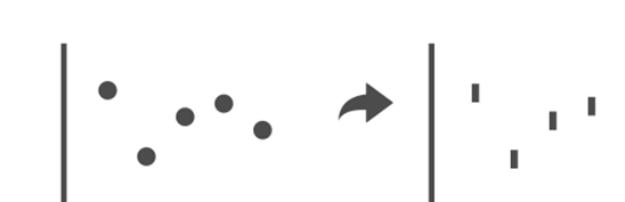
##### → Slice



##### → Cut



##### → Project



## Filtering and Aggregation

## Items

## Attributes

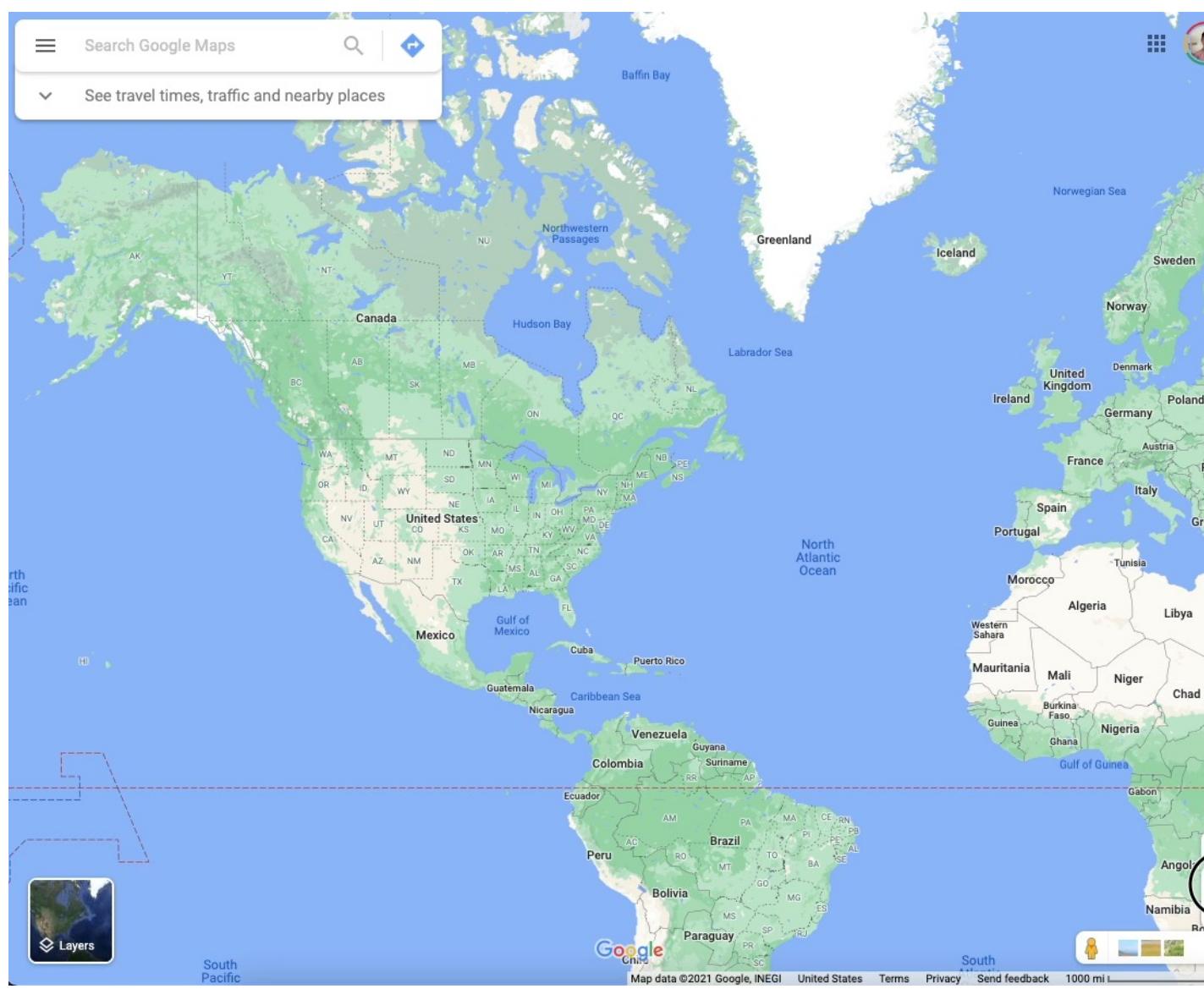
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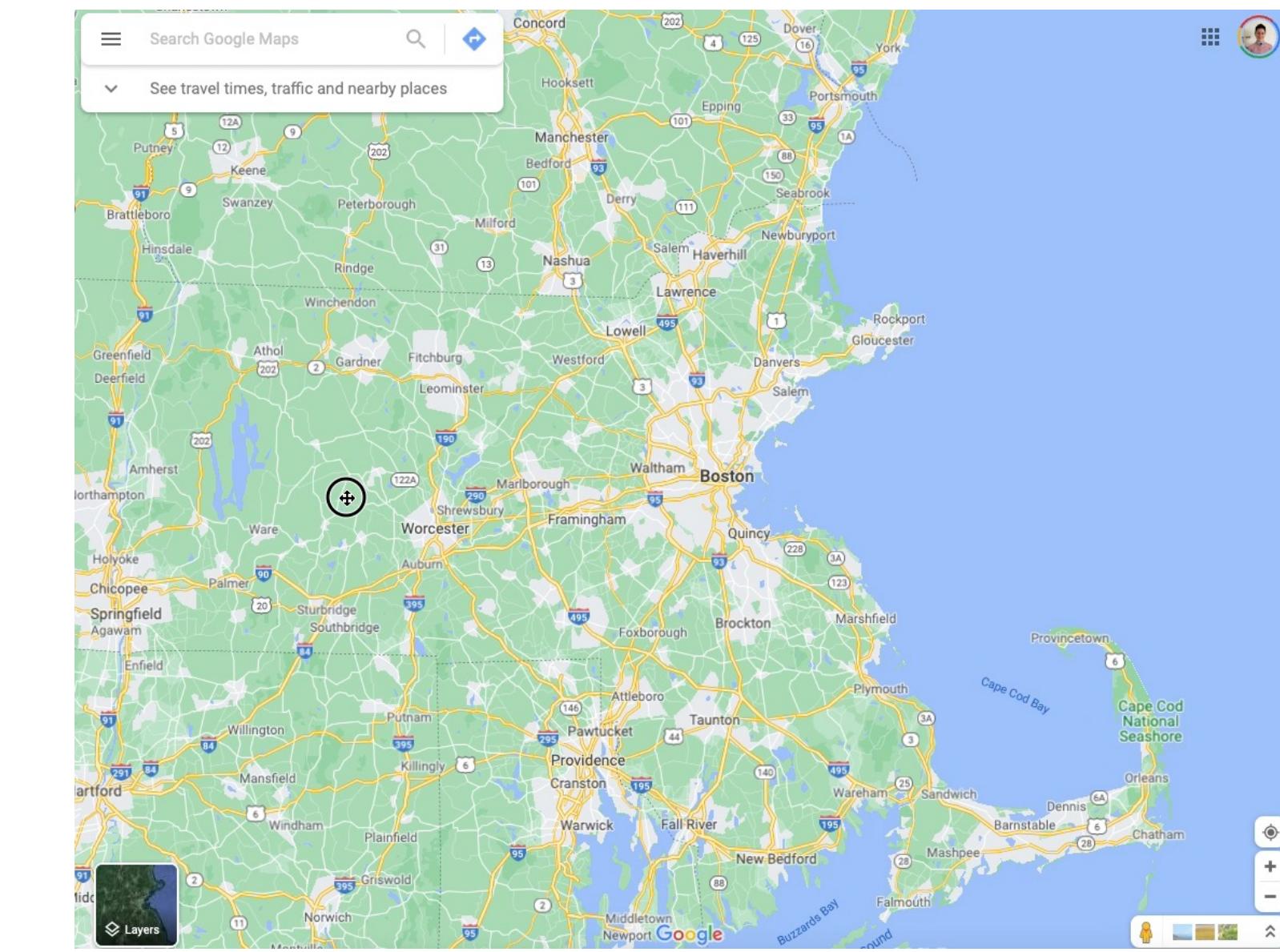
**Navigate → Item reduction → Pan/Zoom**

→ Zoom

*Geometric or Semantic*

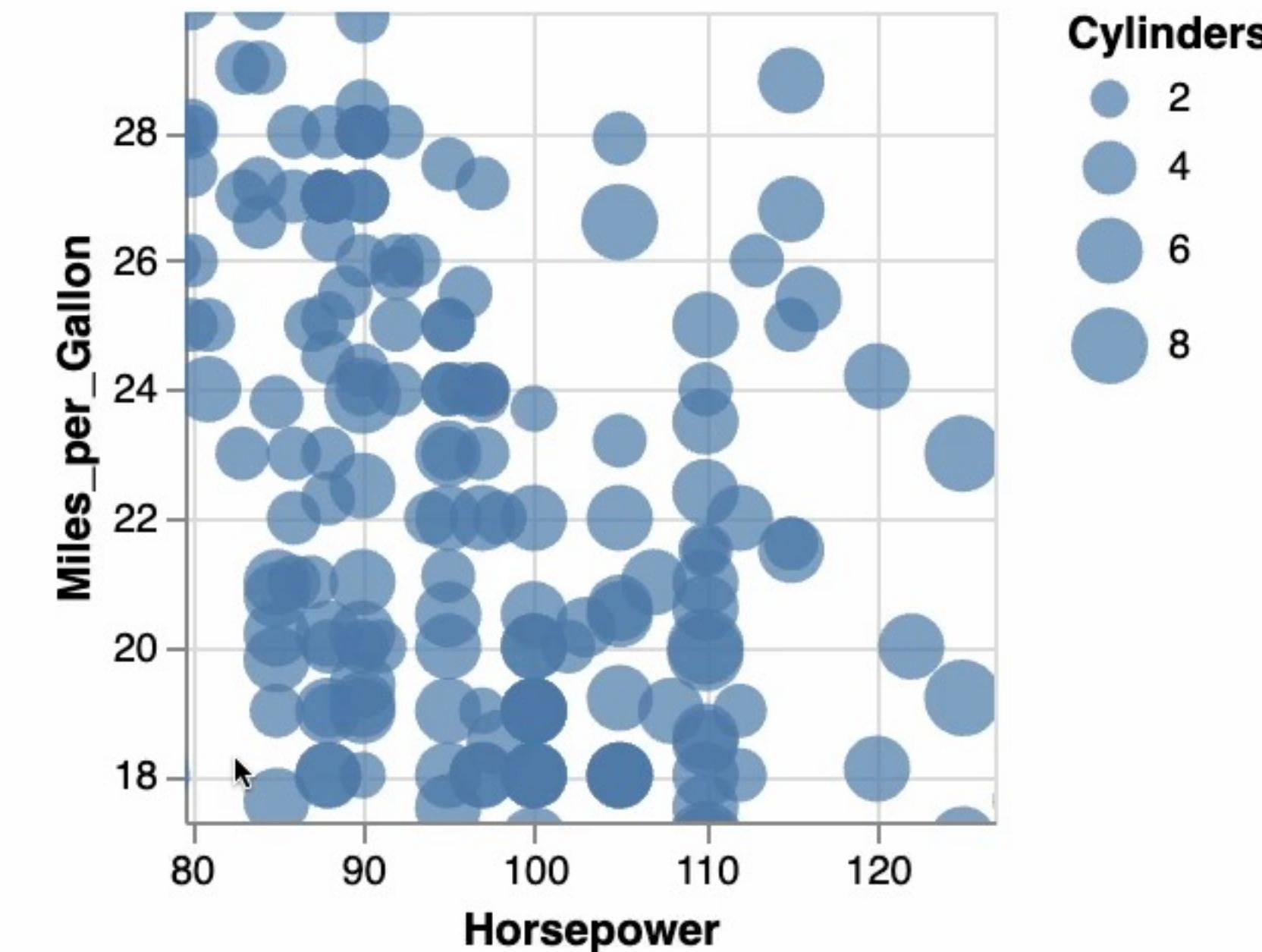
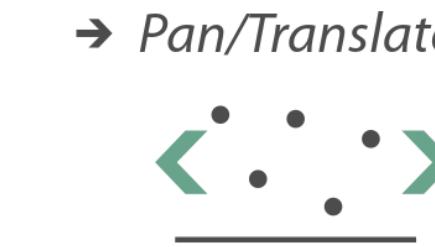
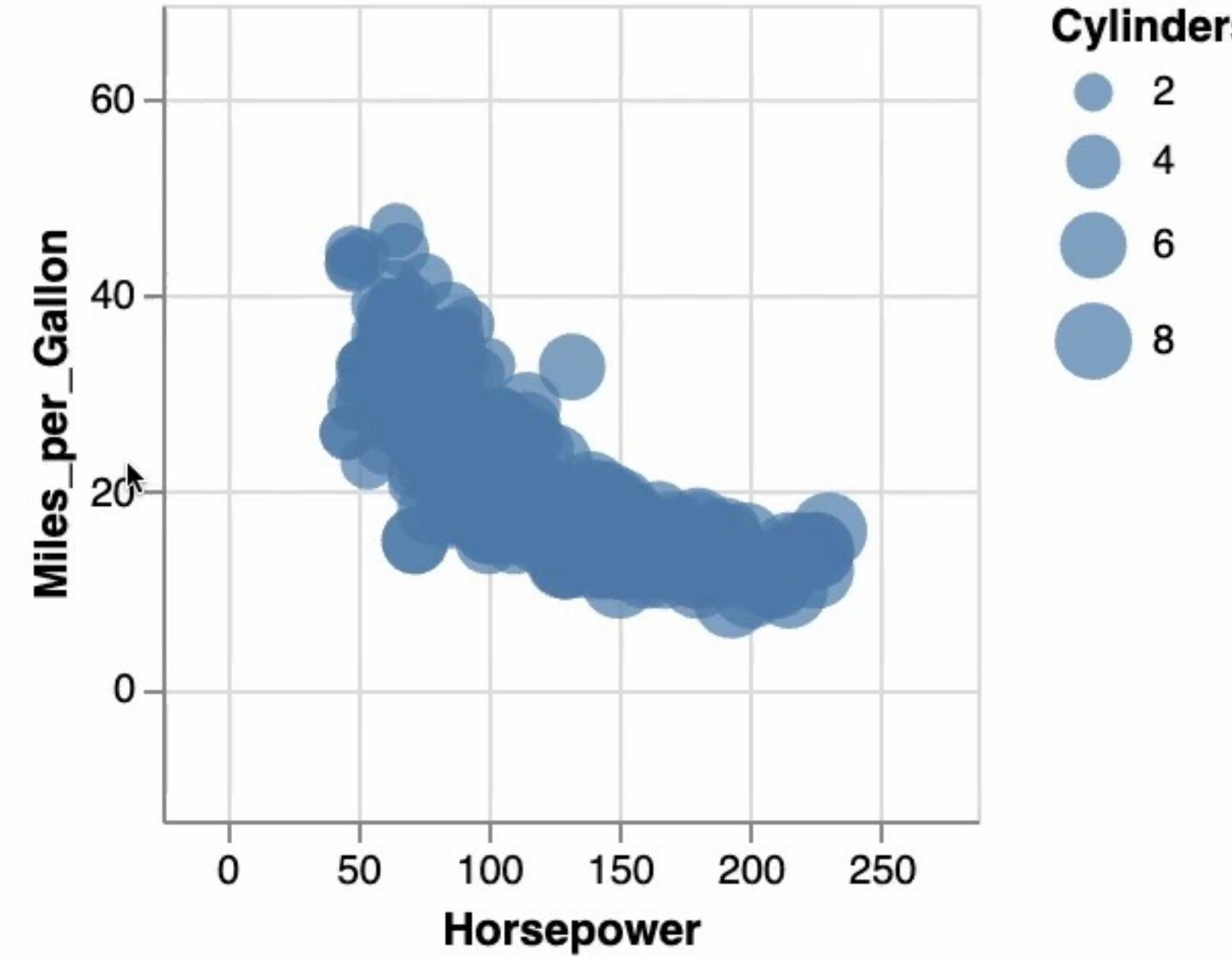
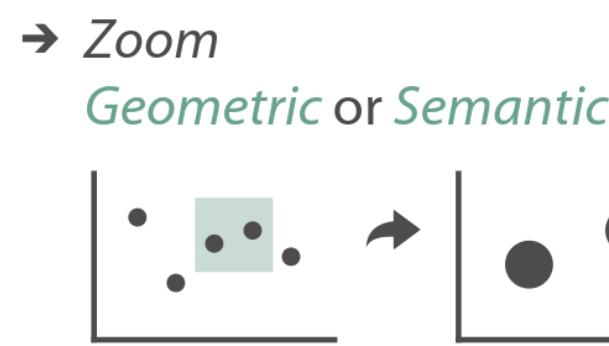


→ Pan/Translate



# Interaction Taxonomies: Munzner

**Navigate → Item reduction → Pan/Zoom**



# Interaction Taxonomies: Yi et al.

## Toward a Deeper Understanding of the Role of Interaction in Information Visualization

Ji Soo Yi, Youn ah Kang, John T. Stasko, *Member, IEEE*, and Julie A. Jacko

- *Select*: mark something as interesting
- *Explore*: show me something else
- *Reconfigure*: show me a different arrangement
- *Encode*: show me a different representation
- *Abstract/Elaborate*: show me more or less detail
- *Filter*: show me something conditionally
- *Connect*: show me related items

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flexible transitions

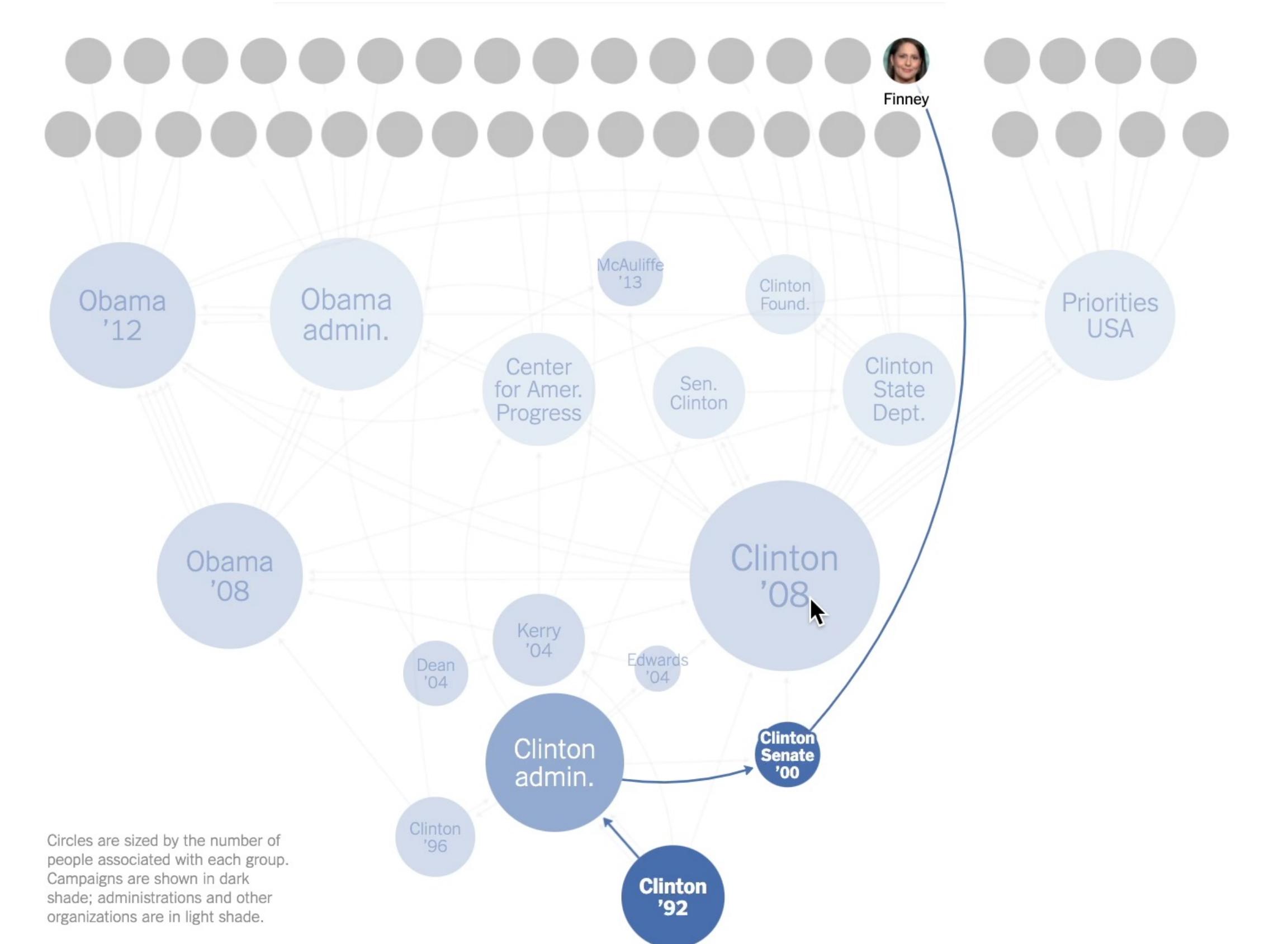
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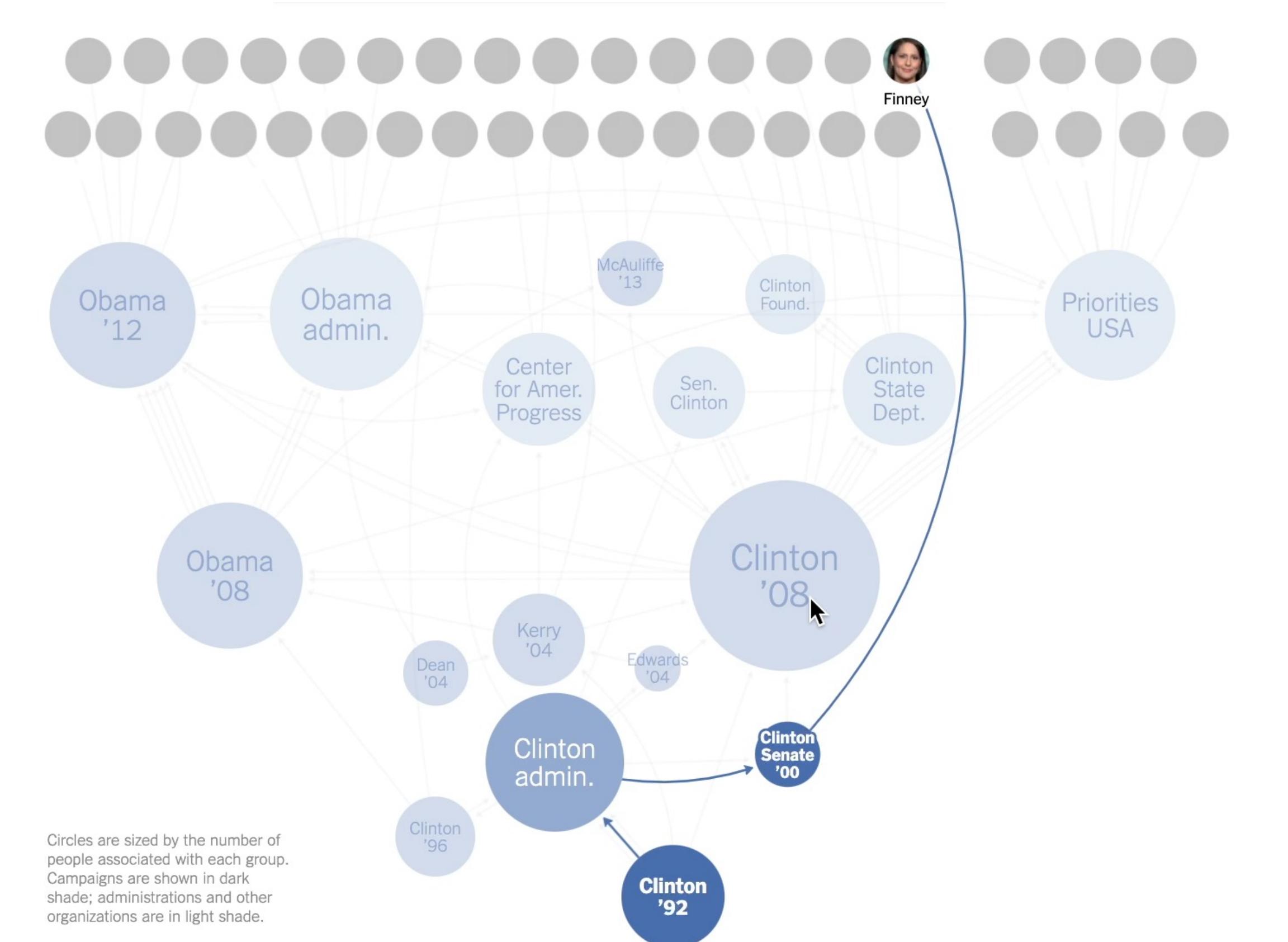
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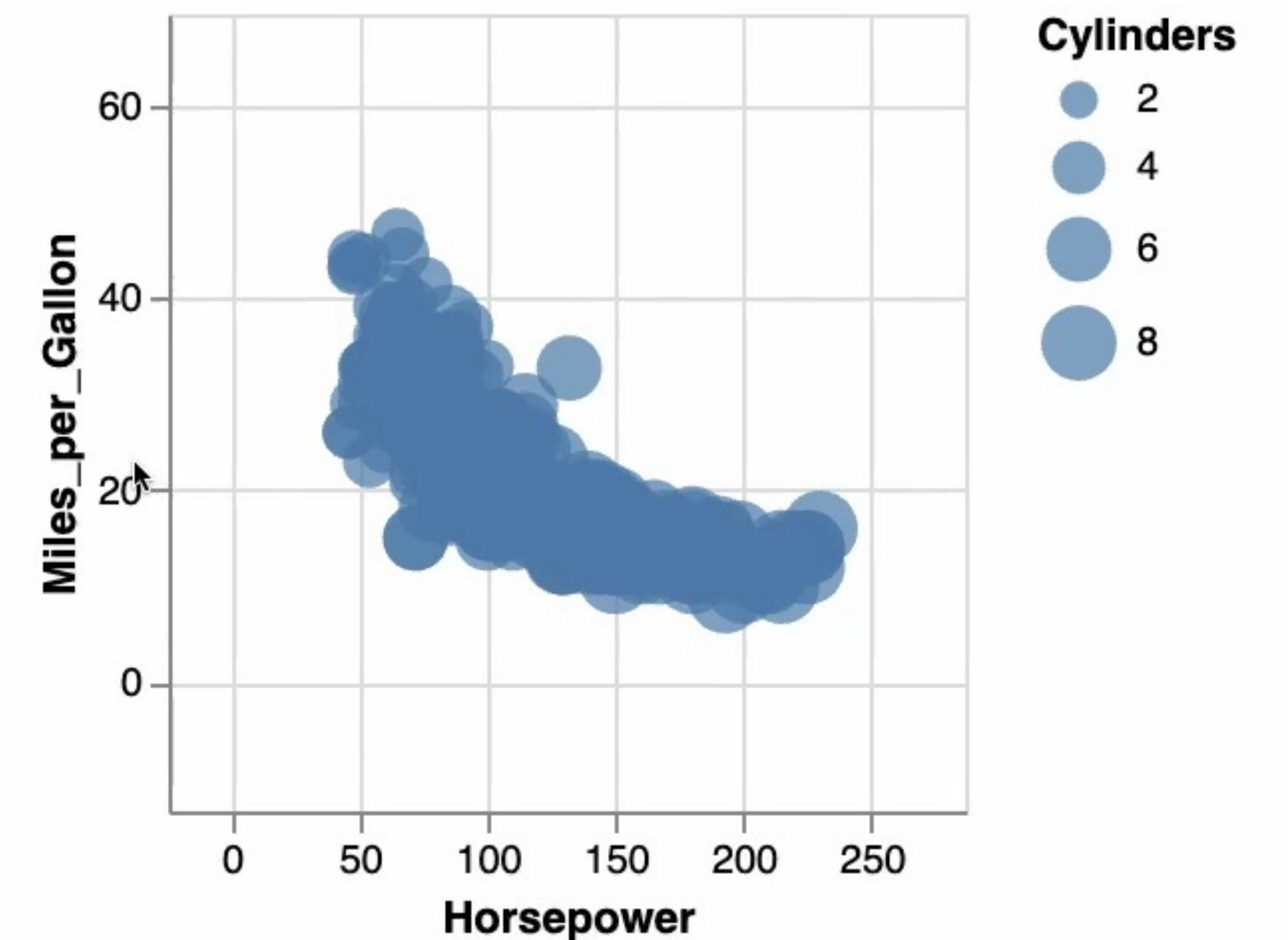
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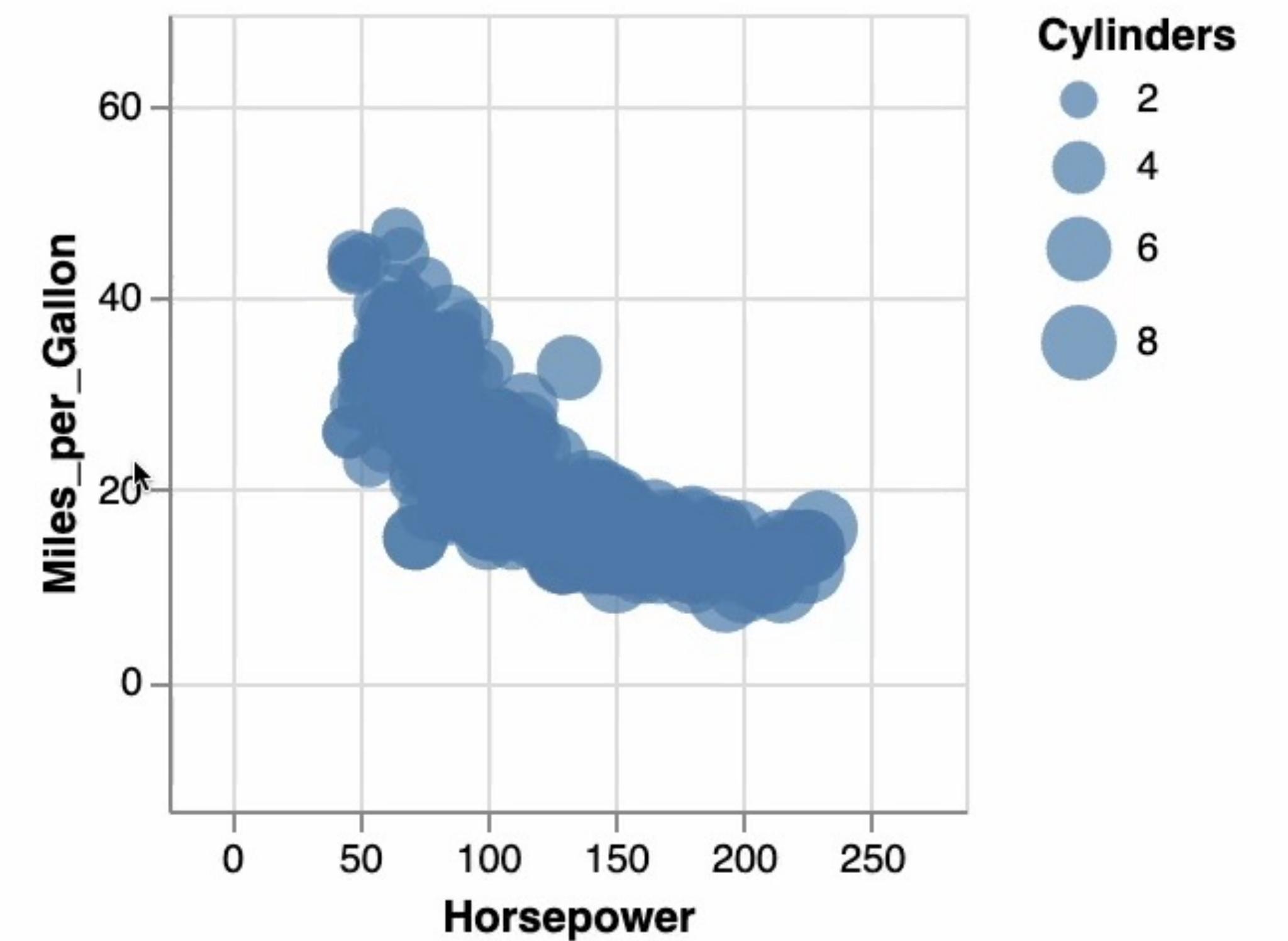
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[https://vega.github.io/vega-lite/examples/selection\\_translate\\_scatterplot\\_drag.html](https://vega.github.io/vega-lite/examples/selection_translate_scatterplot_drag.html)

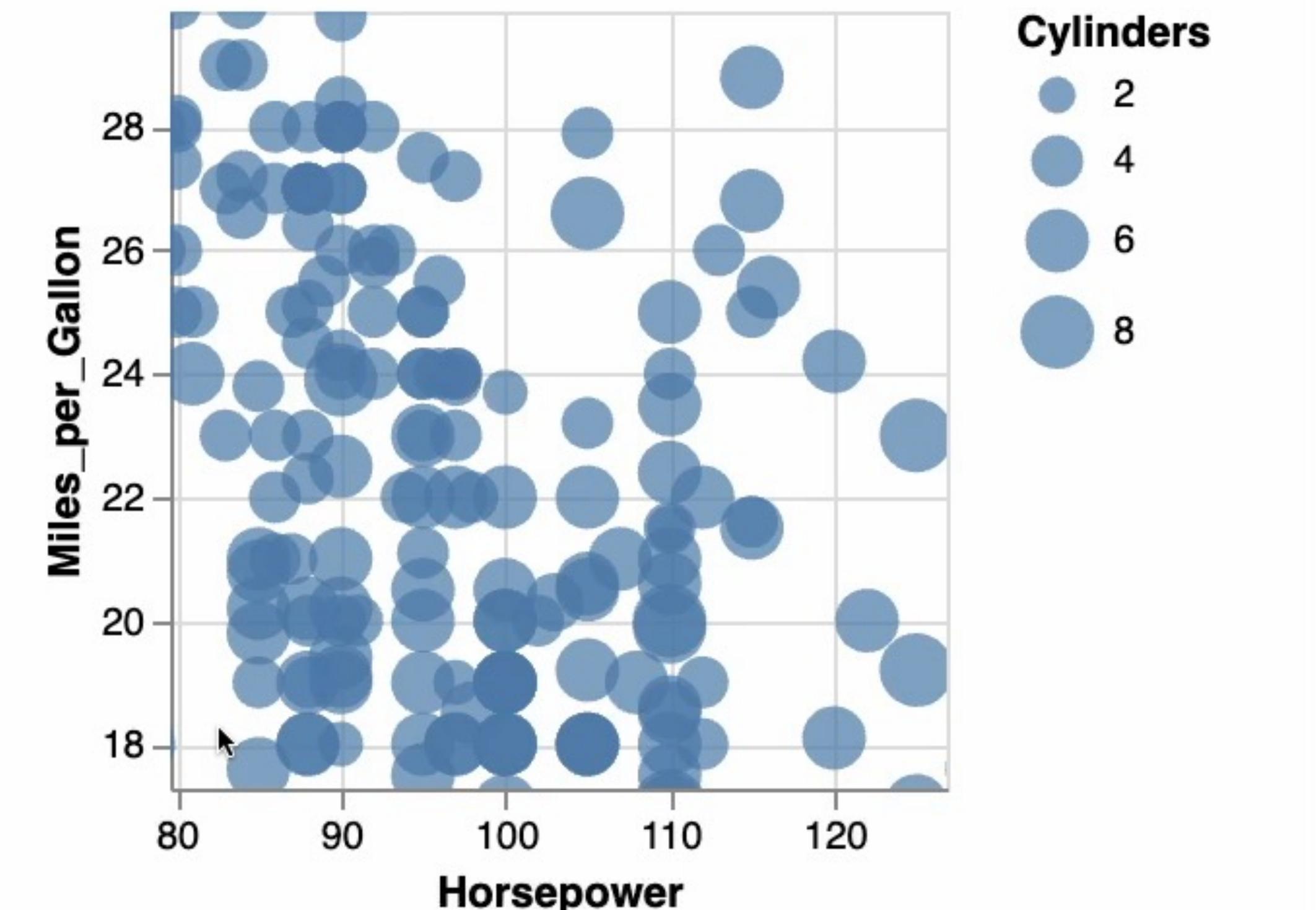
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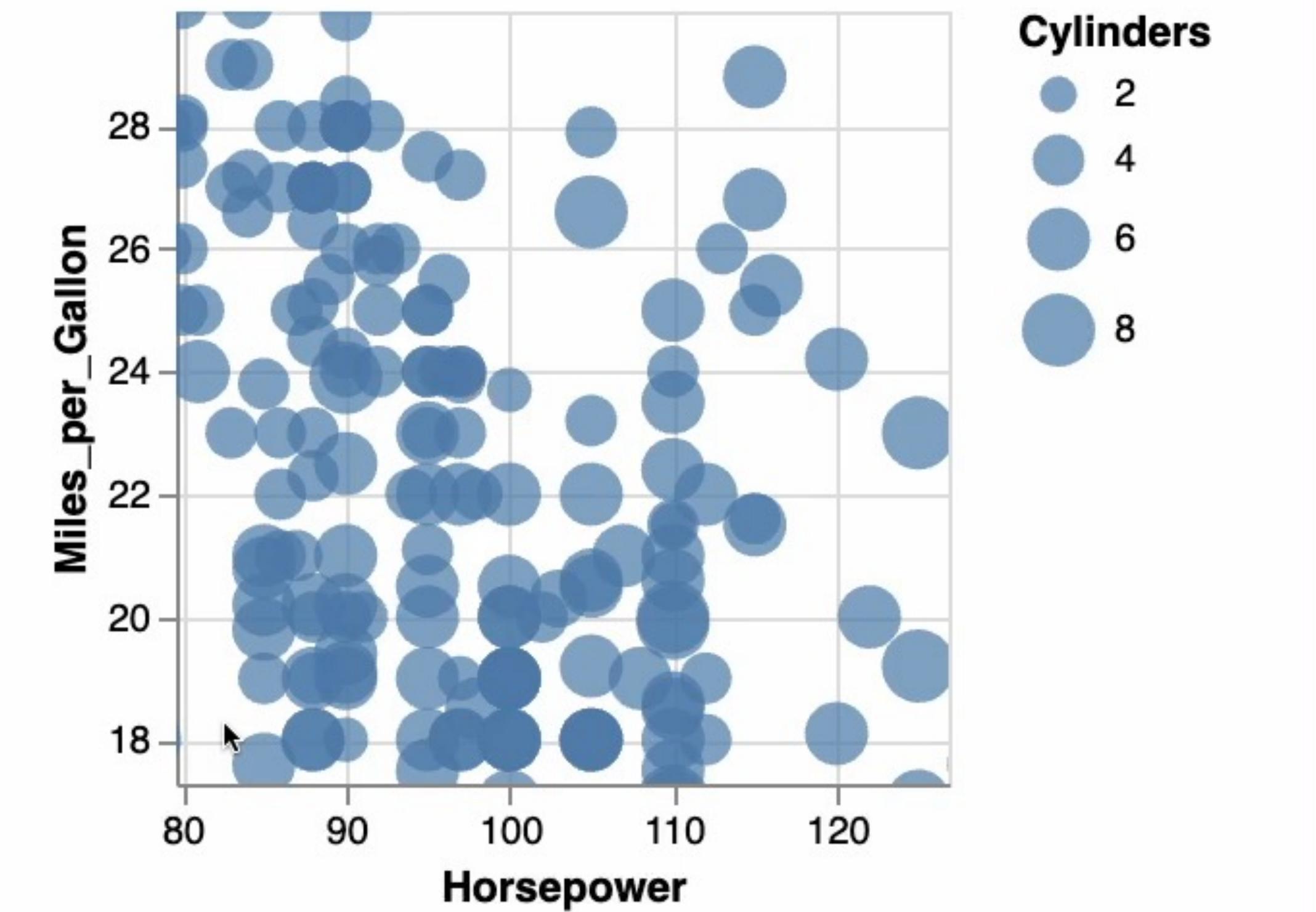
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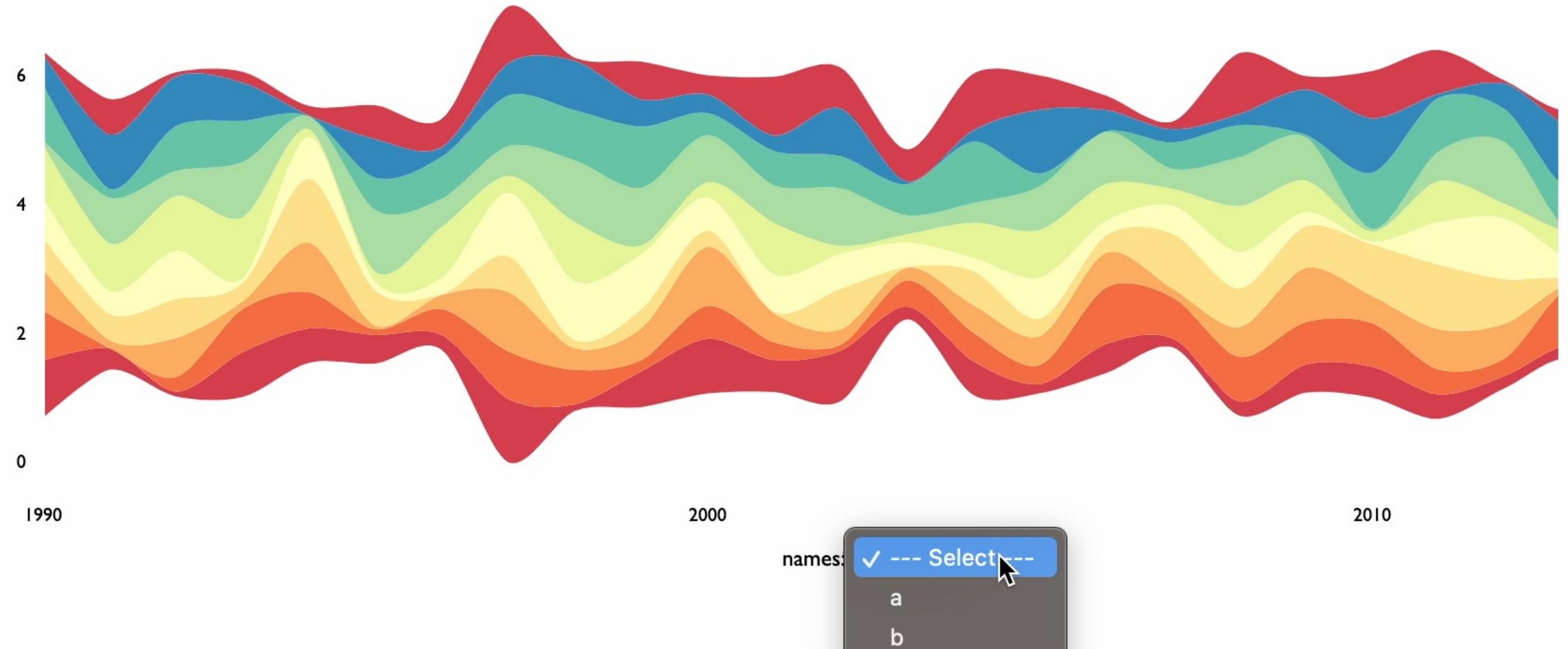


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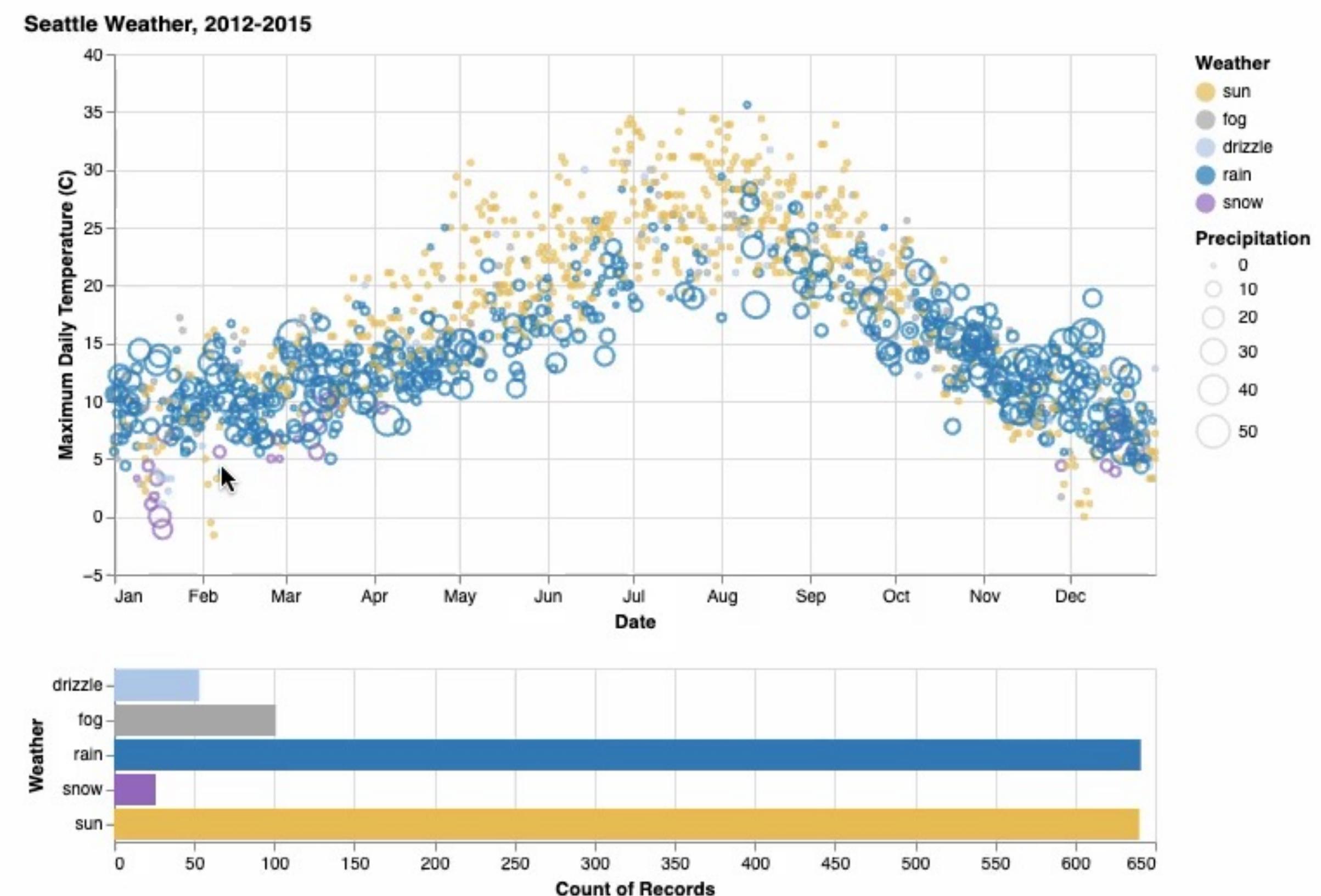
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[https://vega.github.io/vega-lite/examples/interactive\\_seattle\\_weather.html](https://vega.github.io/vega-lite/examples/interactive_seattle_weather.html)

# FACETING

From Munzner's book

# Visualizing Big Data



# Faceting

**Facet (verb) = to split**

# Faceting

**Facet (verb) = to split**

In visualization, it means:

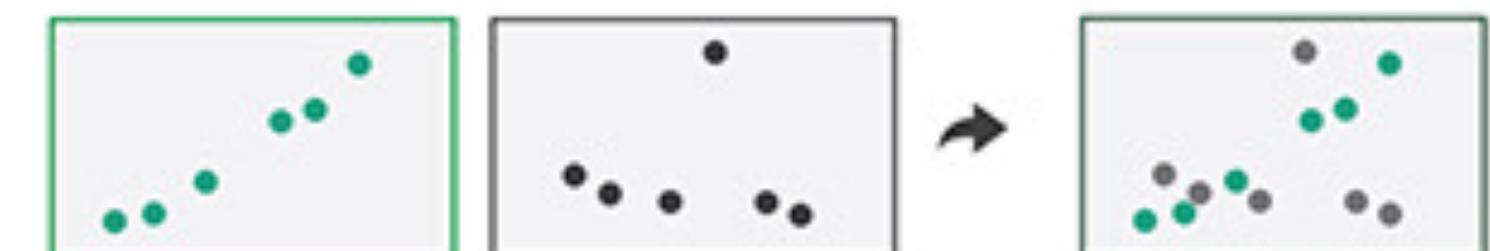
split into multiple views

or separate into layers

④ Partition into Side-by-Side Views



④ Superimpose Layers



# Faceting

**Facet (verb) = to split**

In visualization, it means:

split into multiple views

or separate into layers

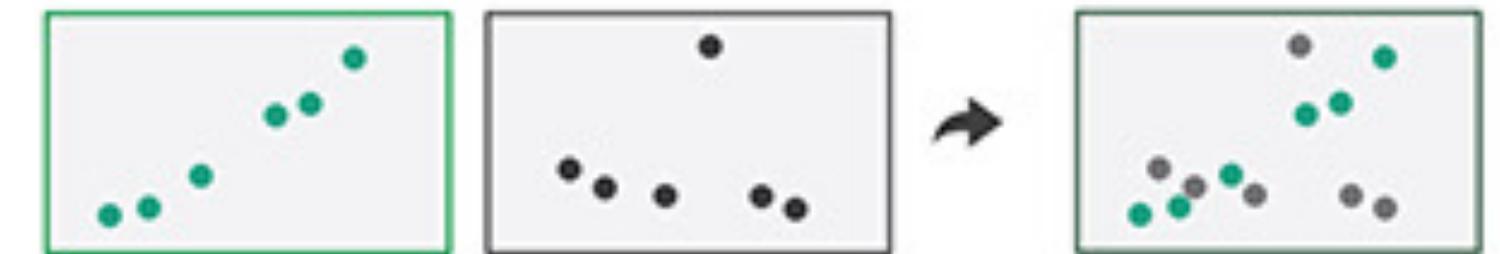
**Why?**

- complexity reduction
- rely on vision instead of memory retrieval

④ Partition into Side-by-Side Views



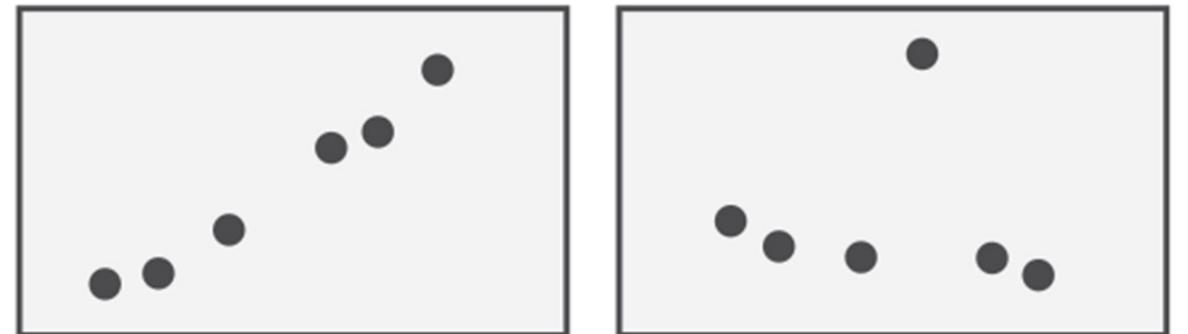
④ Superimpose Layers



# Faceting

## Side-by-Side Views

- Partition into Side-by-Side Views



### Pro:

- Easy to compare

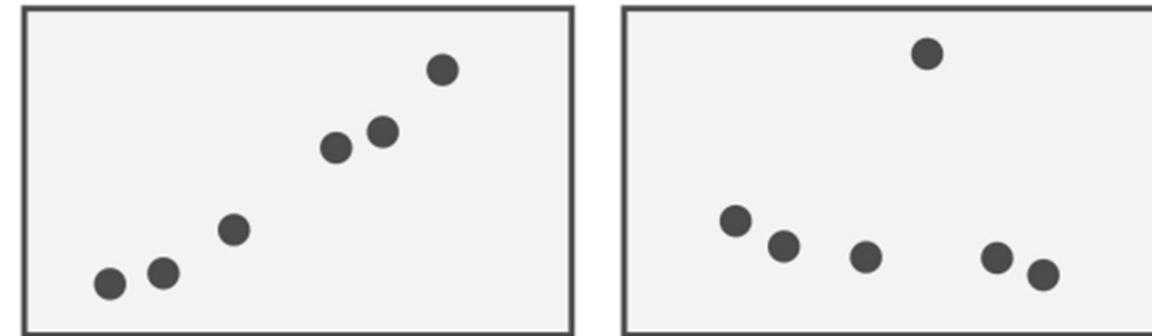
### Con:

- Takes up more space on the screen

# Faceting

## Side-by-Side Views

### → Partition into Side-by-Side Views

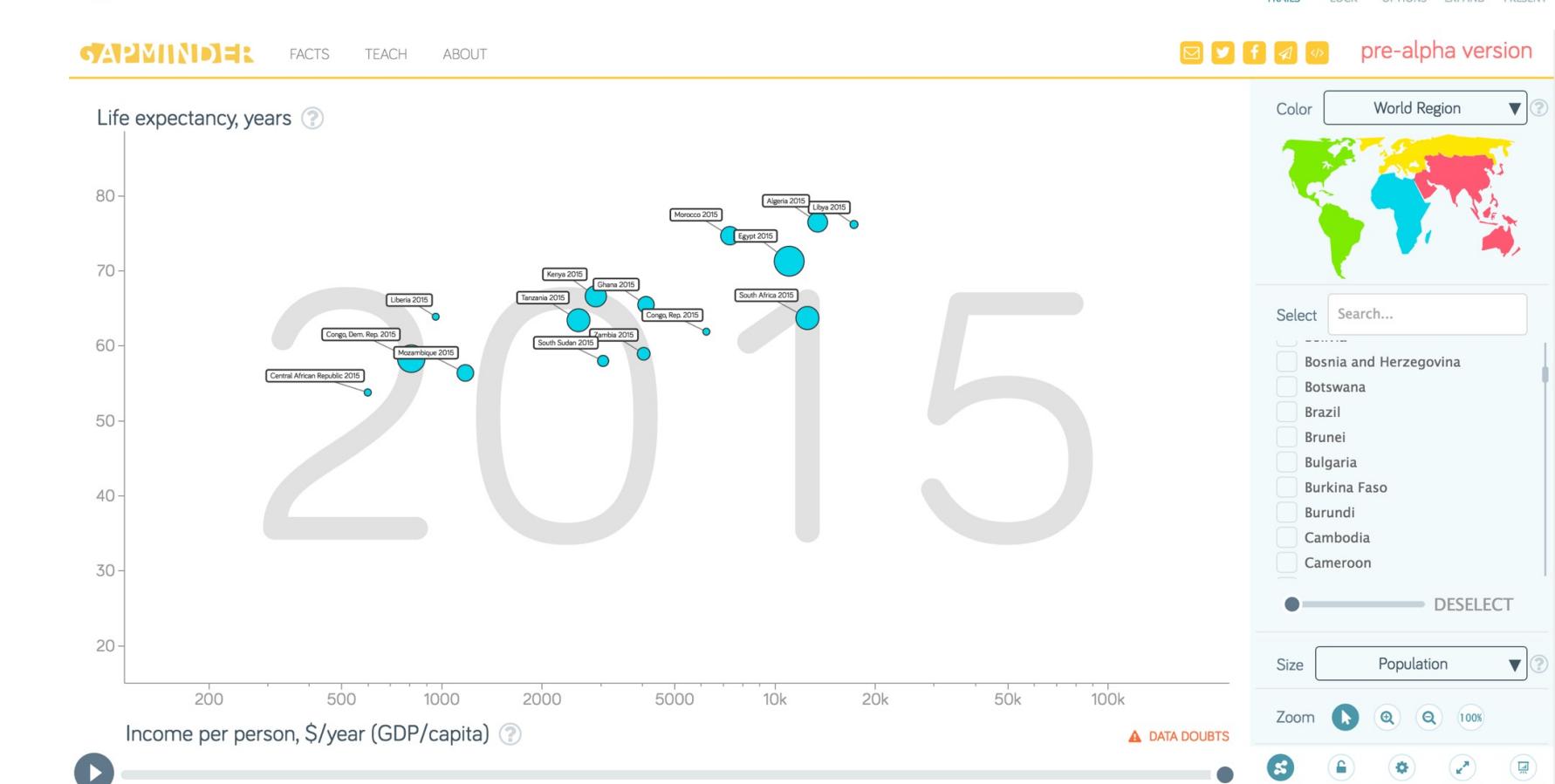
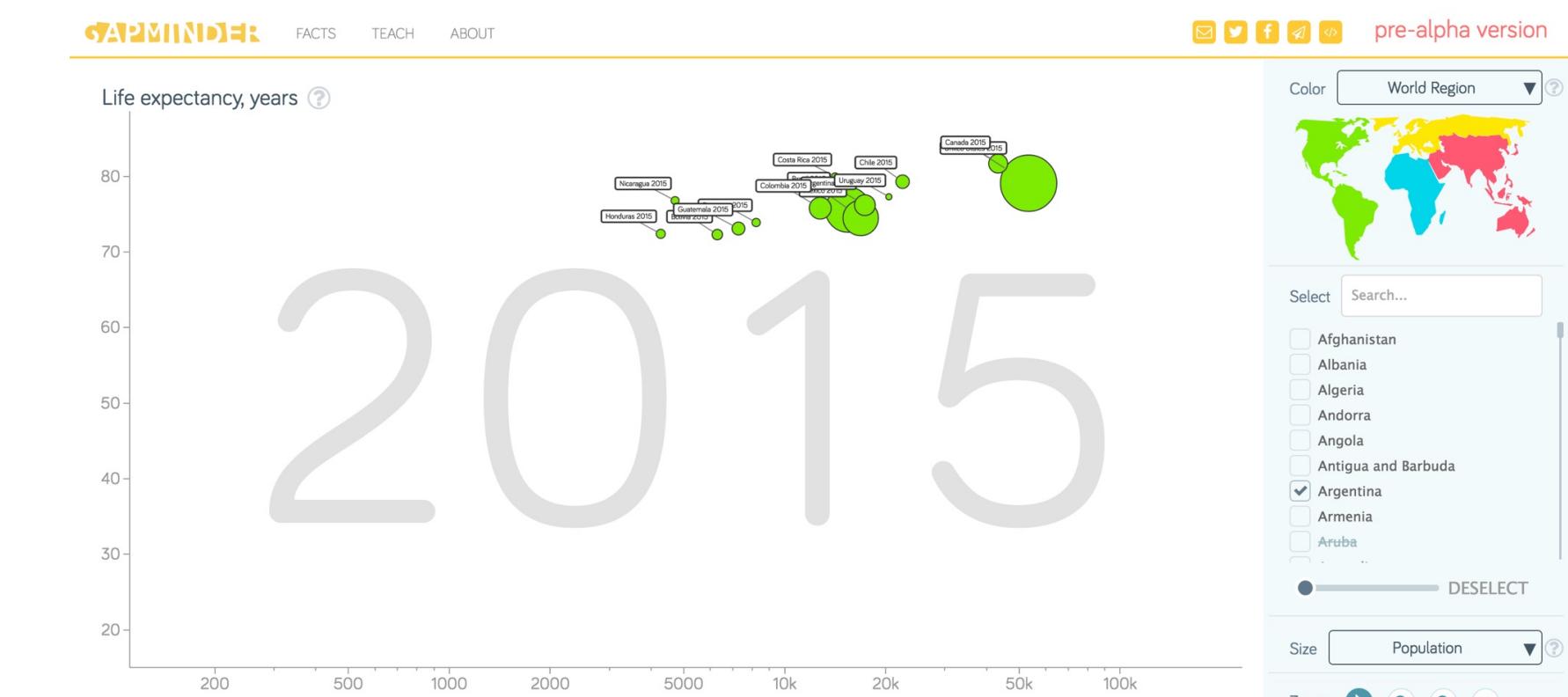


**Pro:**

→ Easy to compare

**Con:**

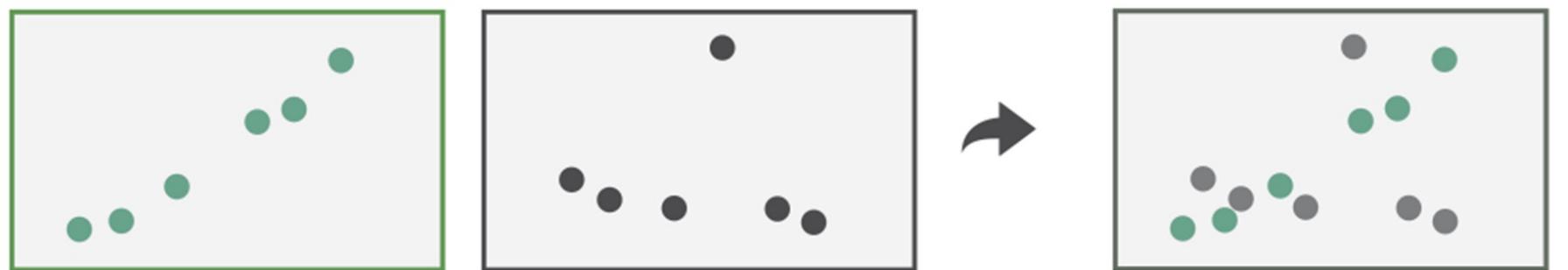
→ Takes up more space on the screen



# Faceting

## Superimposed Layers

### → Superimpose Layers



### Pro:

- Requires less screen space
- Easy to compare

### Con:

- Limits encoding options
- Can get messy

# Faceting

## Superimposed Layers

### → Superimpose Layers

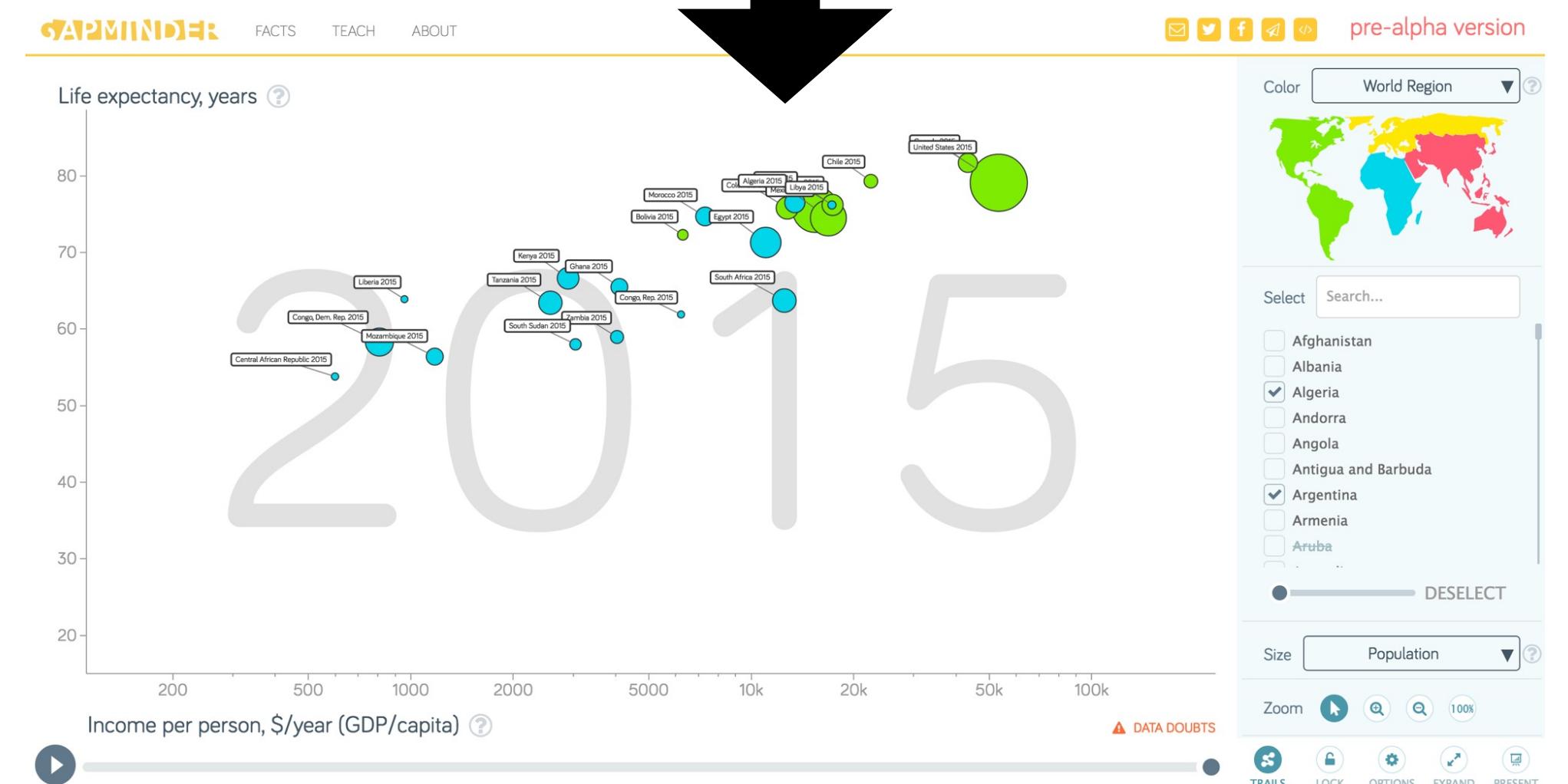
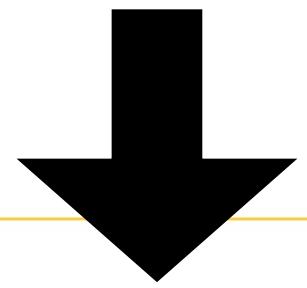
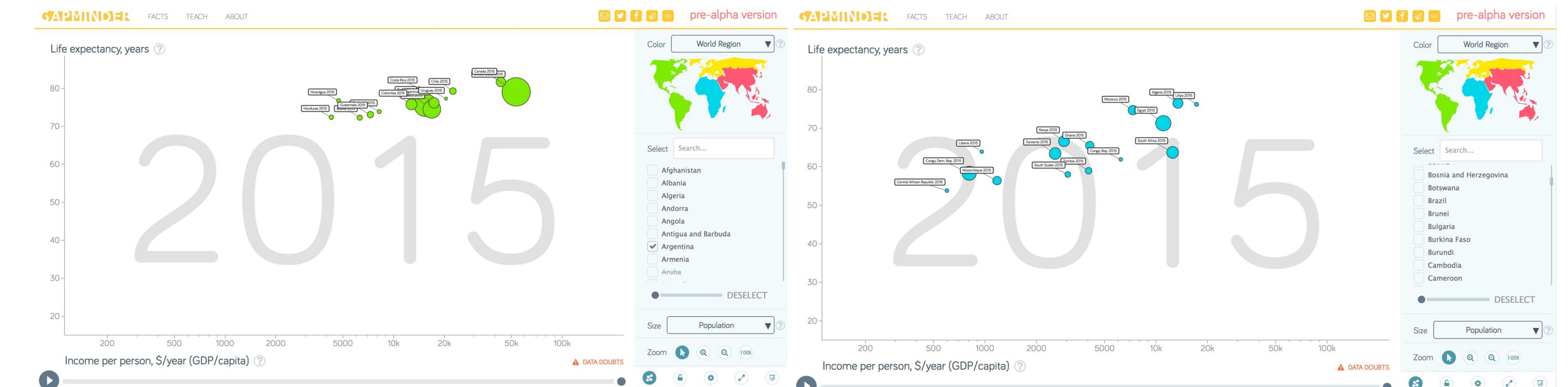


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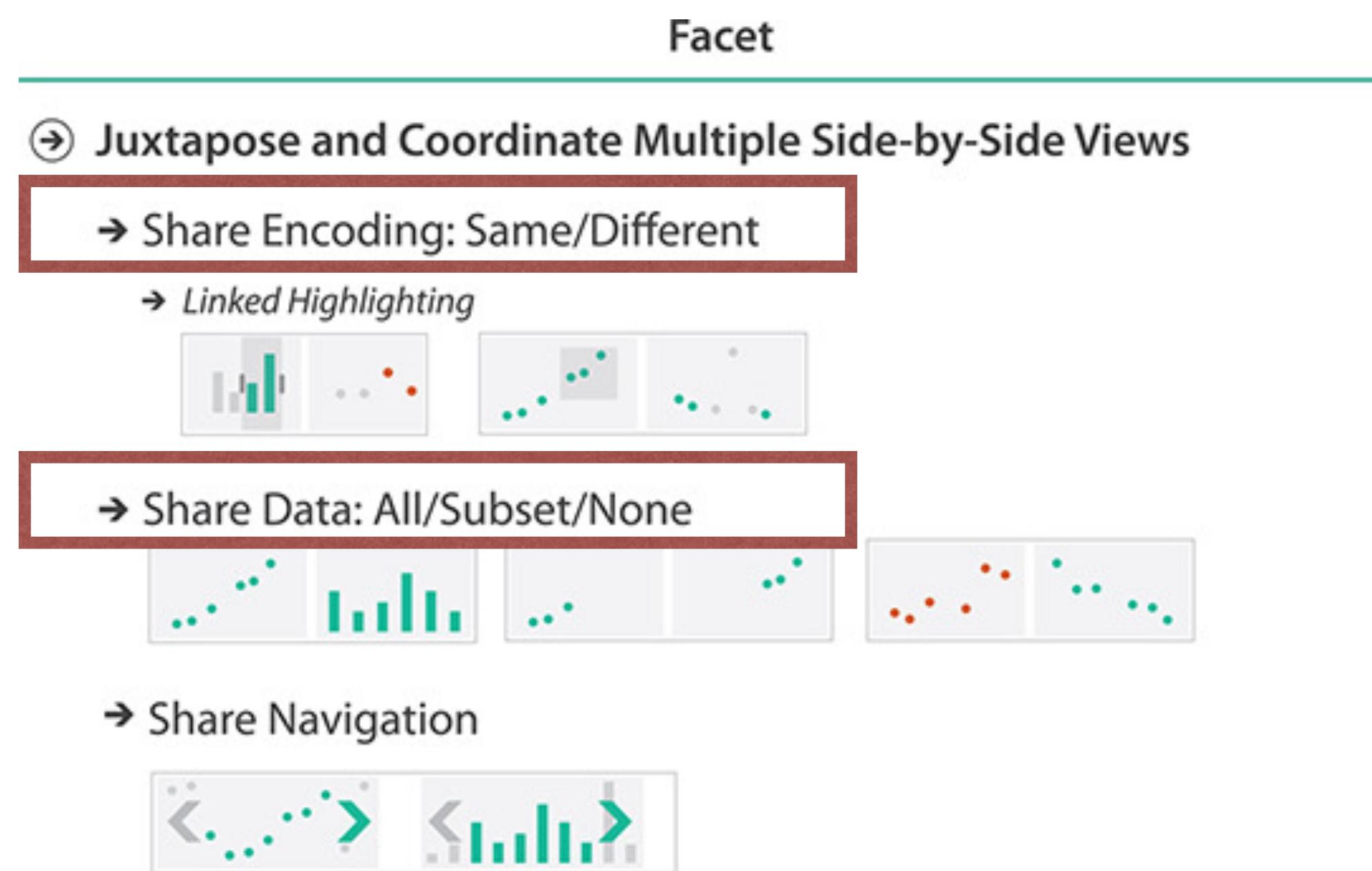


# Faceting

**Coordination** → In addition to arranging views side-by-side vs. superimposed we need to choose how to coordinate them (or not)

# Faceting

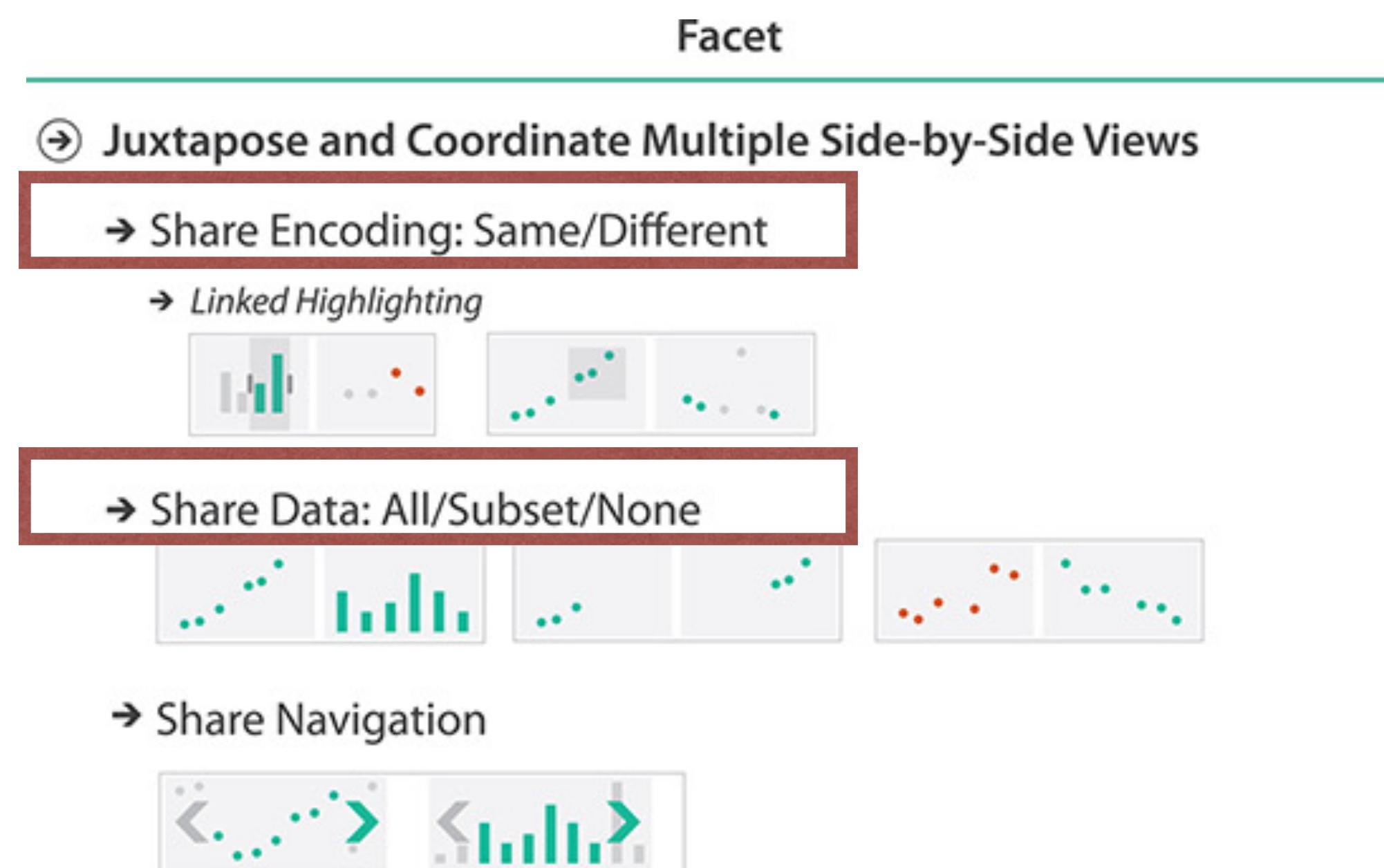
**Coordination** → In addition to arranging views side-by-side vs. superimposed we need to choose how to coordinate them (or not)



Encoding	Data		
	All	Subset	None
Same	Redundant	 Overview/ Detail	 Small Multiples
Different	  Multiform	  Multiform, Overview/ Detail	No Linkage

# Faceting

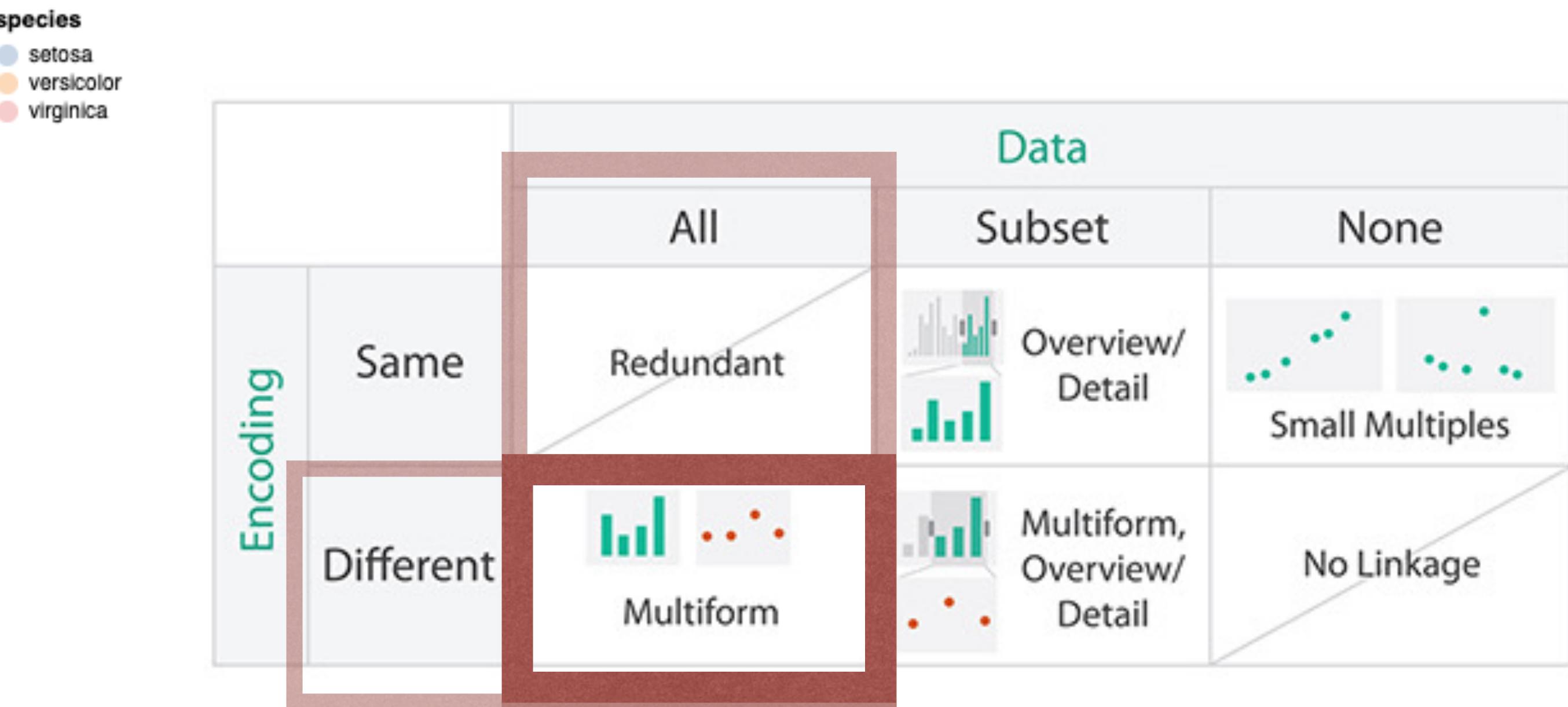
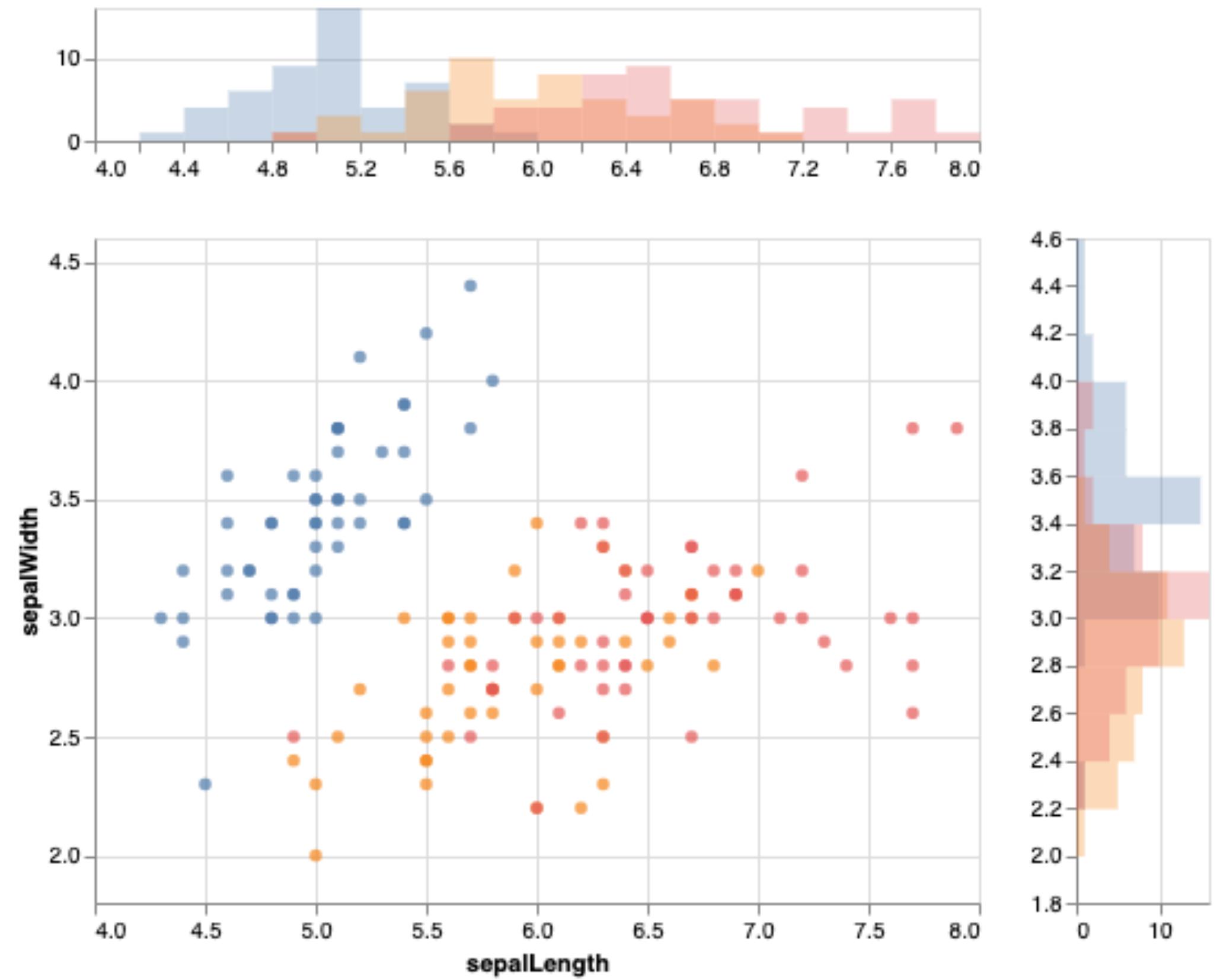
**Coordination → Multiform**



Encoding	Data	All	Redundant	
		Same	Subset	None
Different	Overview/Detail	 	Small Multiples	
	Multiform, Overview/Detail	 	No Linkage	

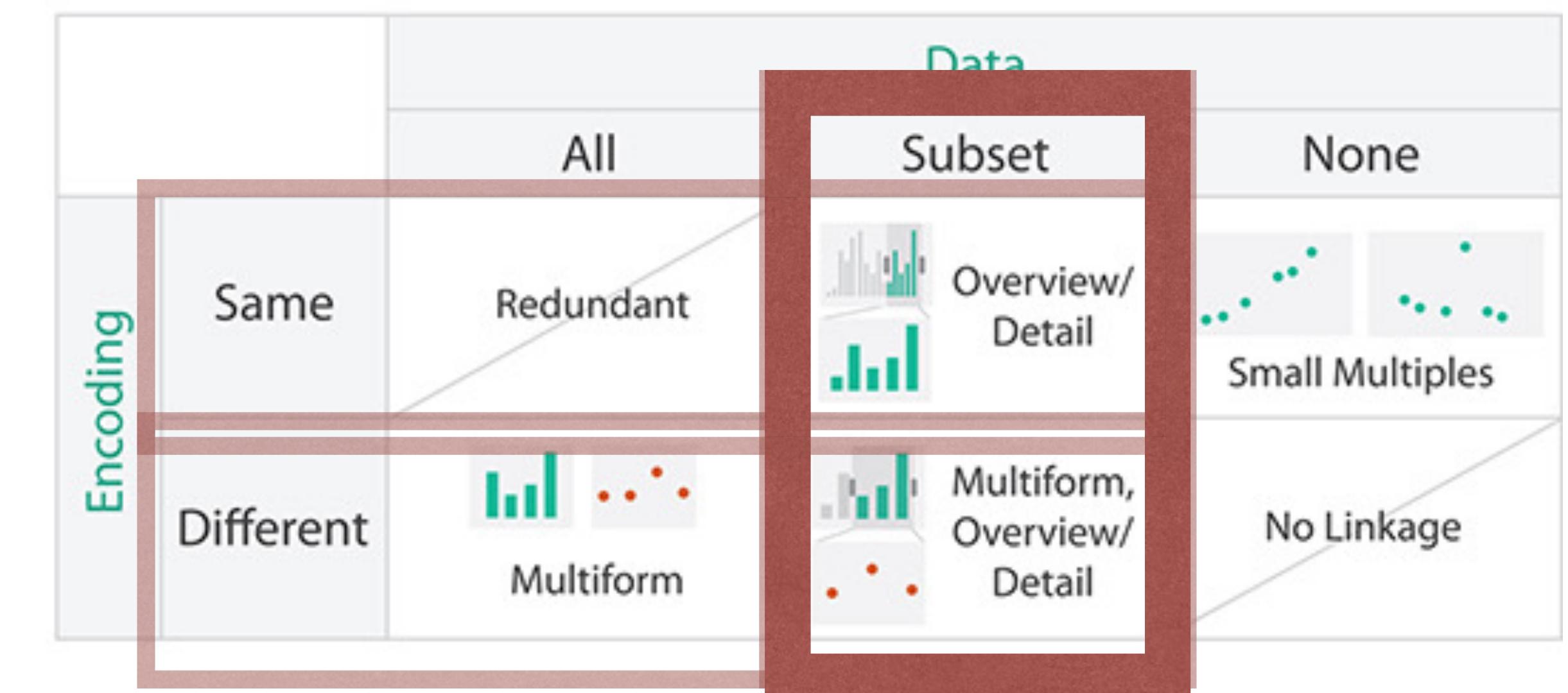
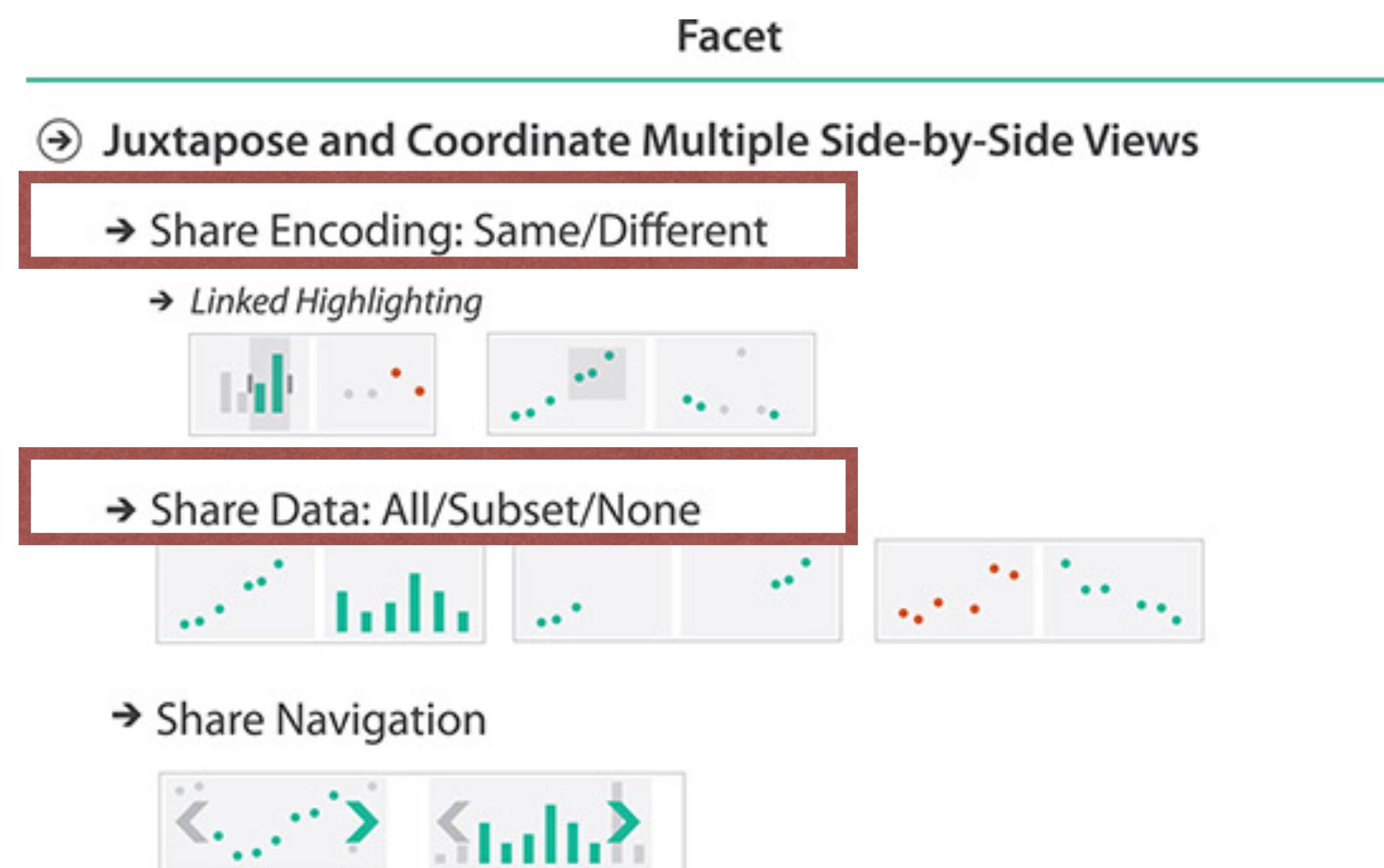
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**Coordination → Multiform**



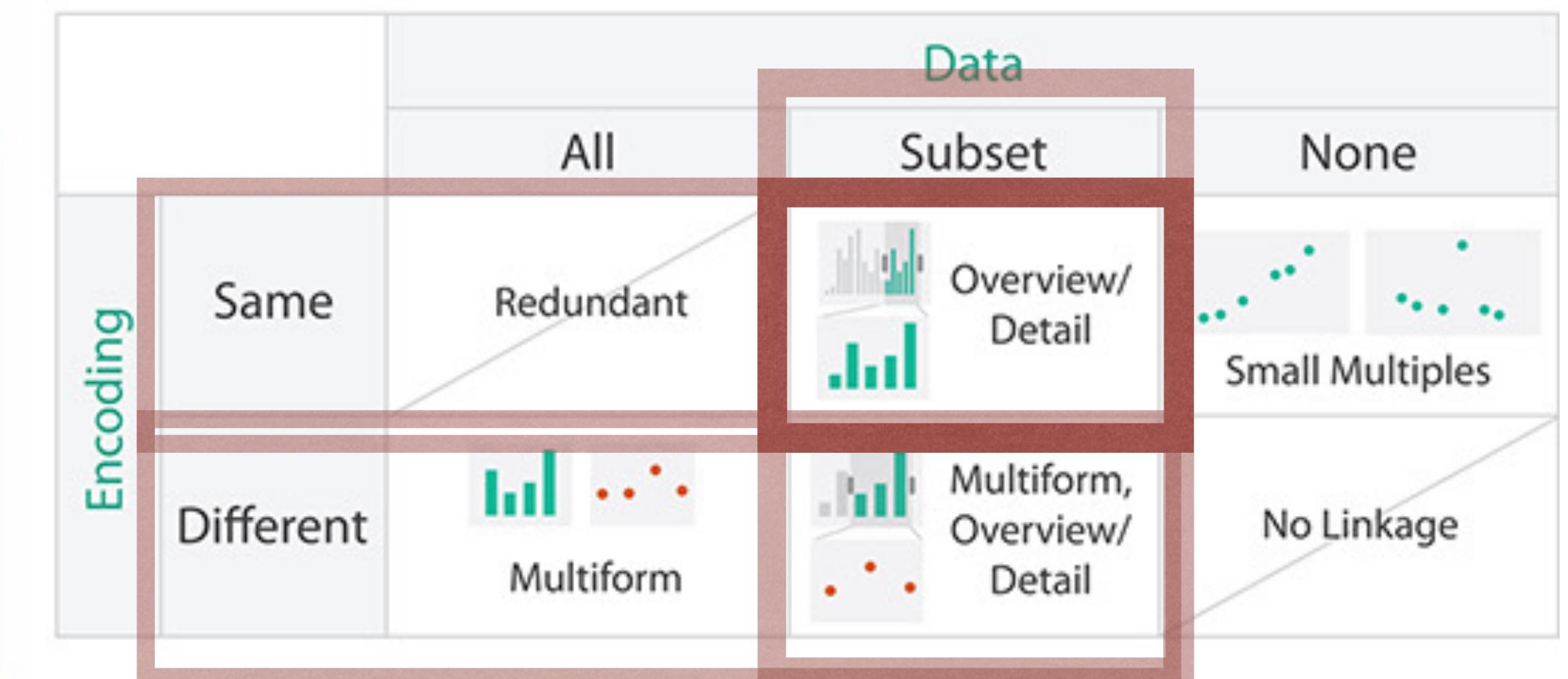
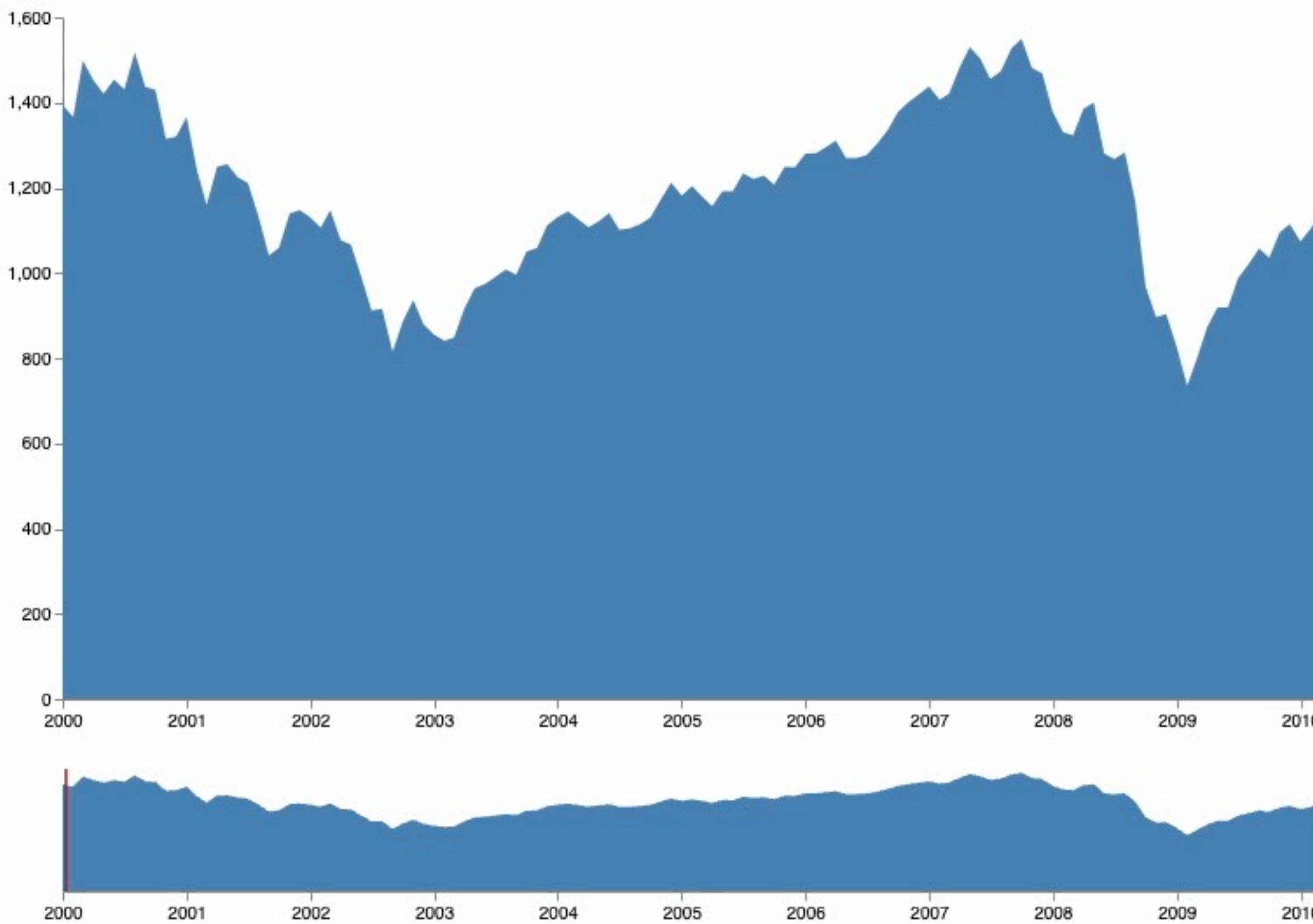
# Faceting

**Coordinate → Overview/Detail**



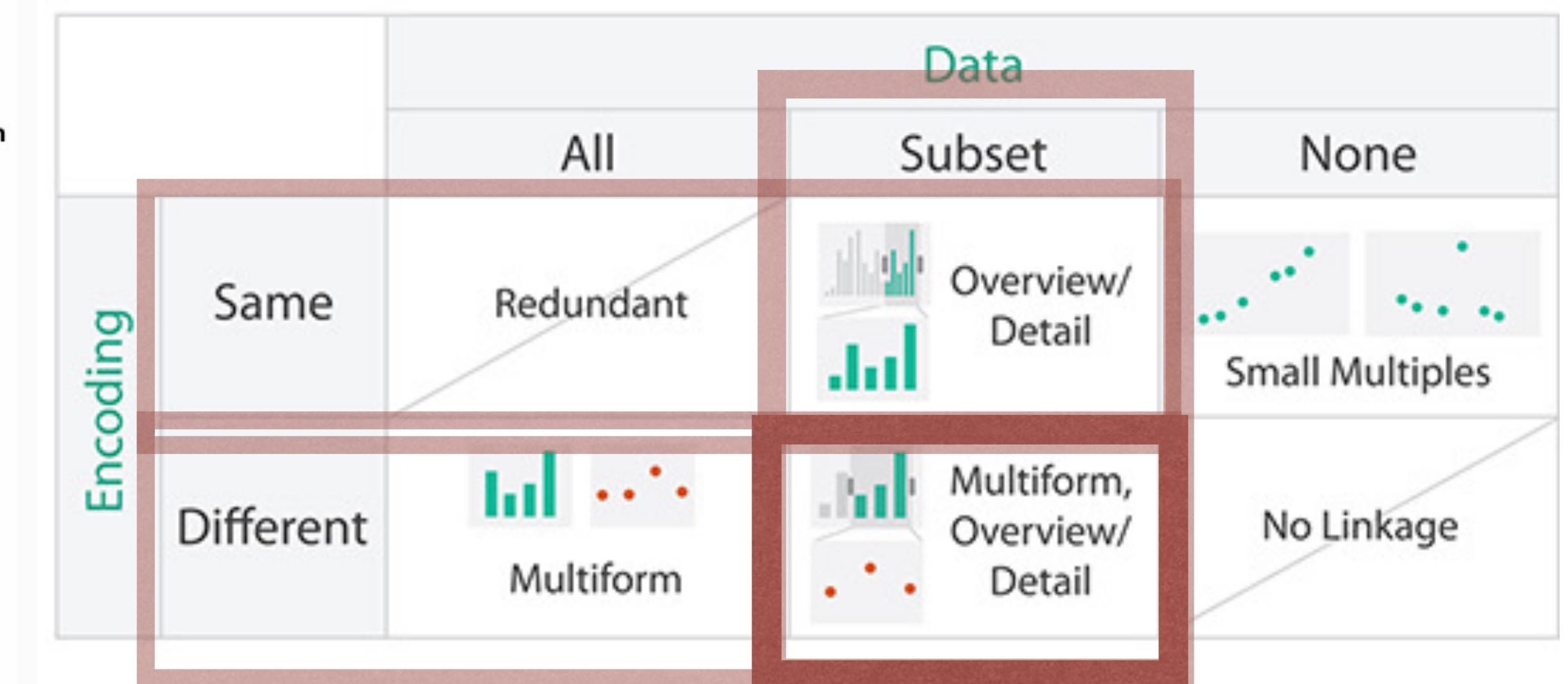
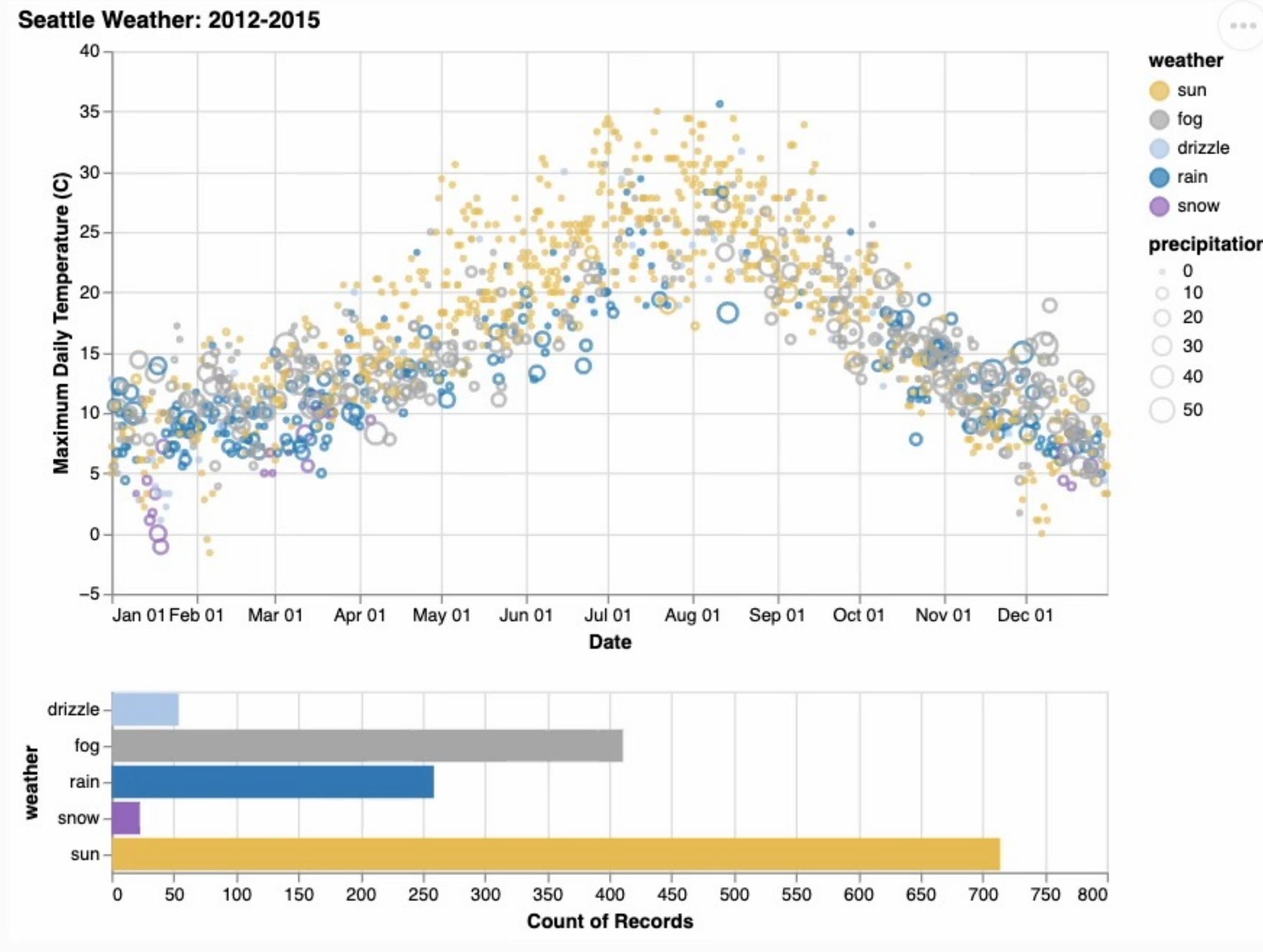
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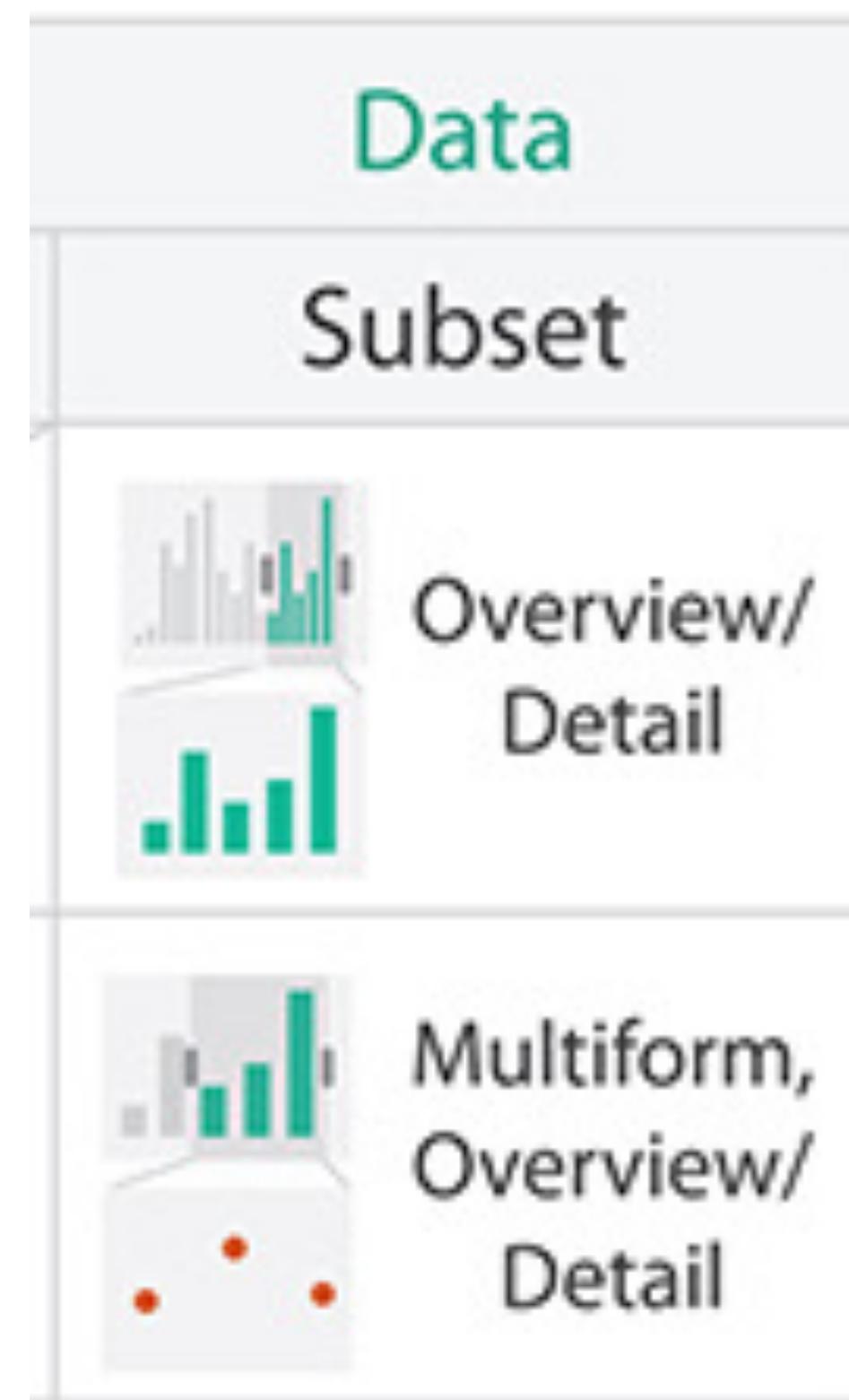


# Faceting

**Coordinate → Overview/Detail**



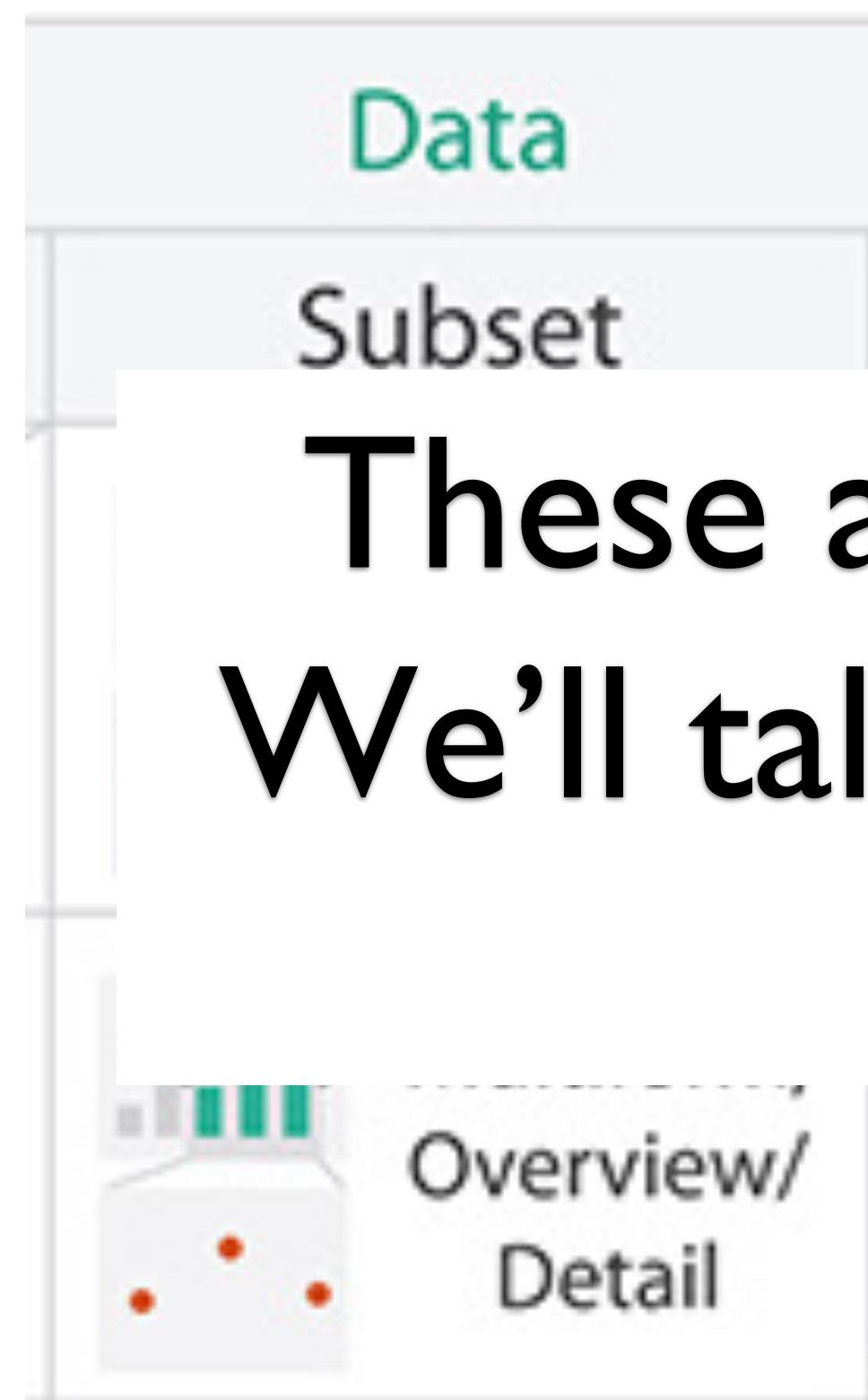
# Overview/Detail



Overview first, zoom and filter, then details-on-demand  
Overview first, zoom and filter, then details-on-demand

- Ben Shneiderman

# Overview/Detail



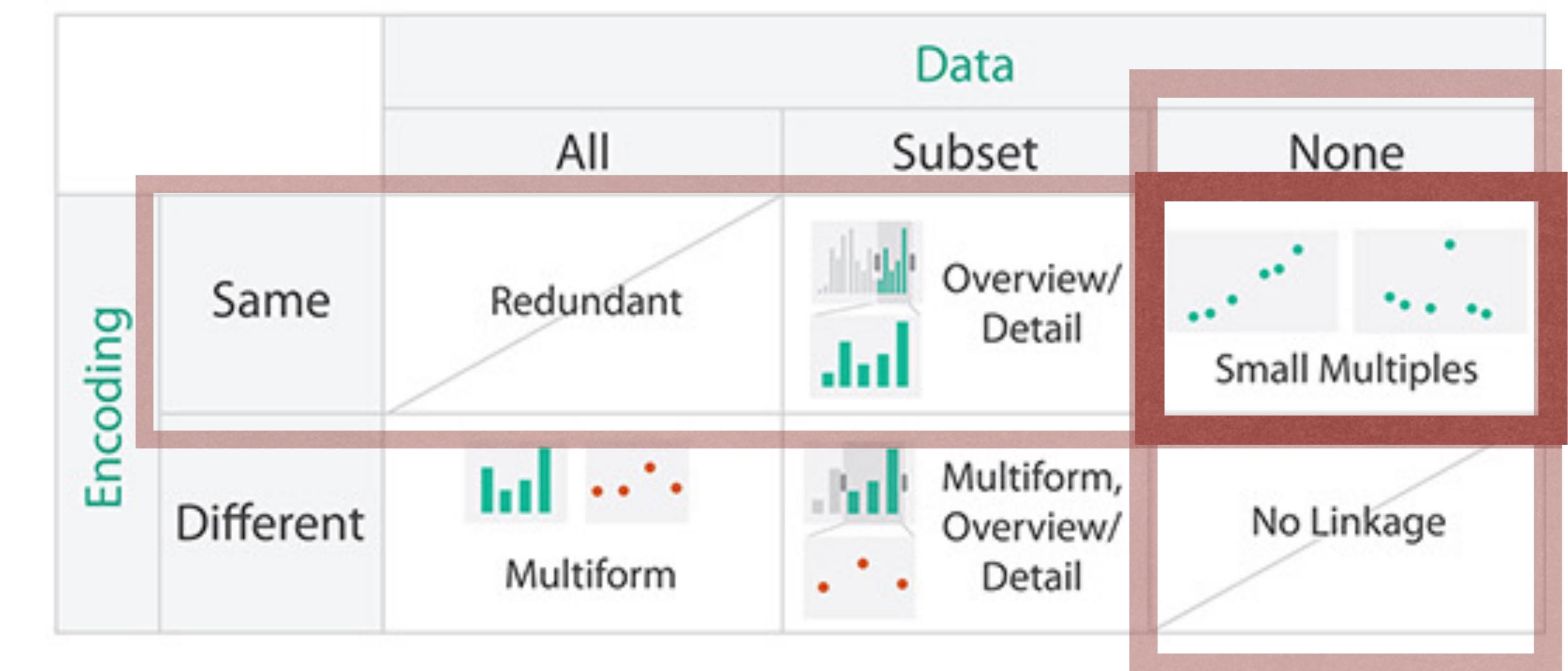
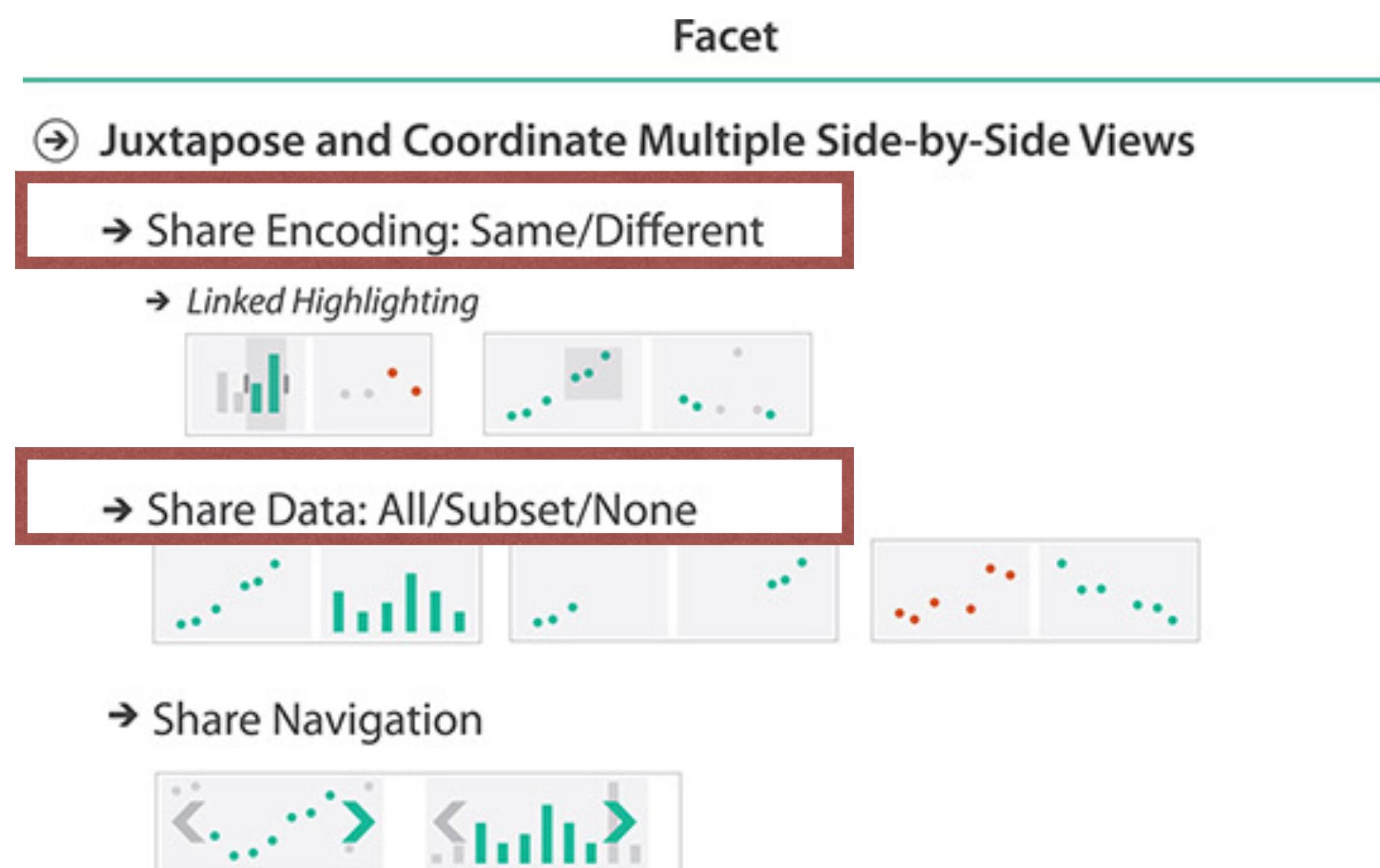
**These are Focus + Context Designs.  
We'll talk more about this approach in  
future lectures.**

OVERVIEW FIRST, ZOOM AND FILTER, THEN DETAILS-ON-DEMAND

- Ben Shneiderman

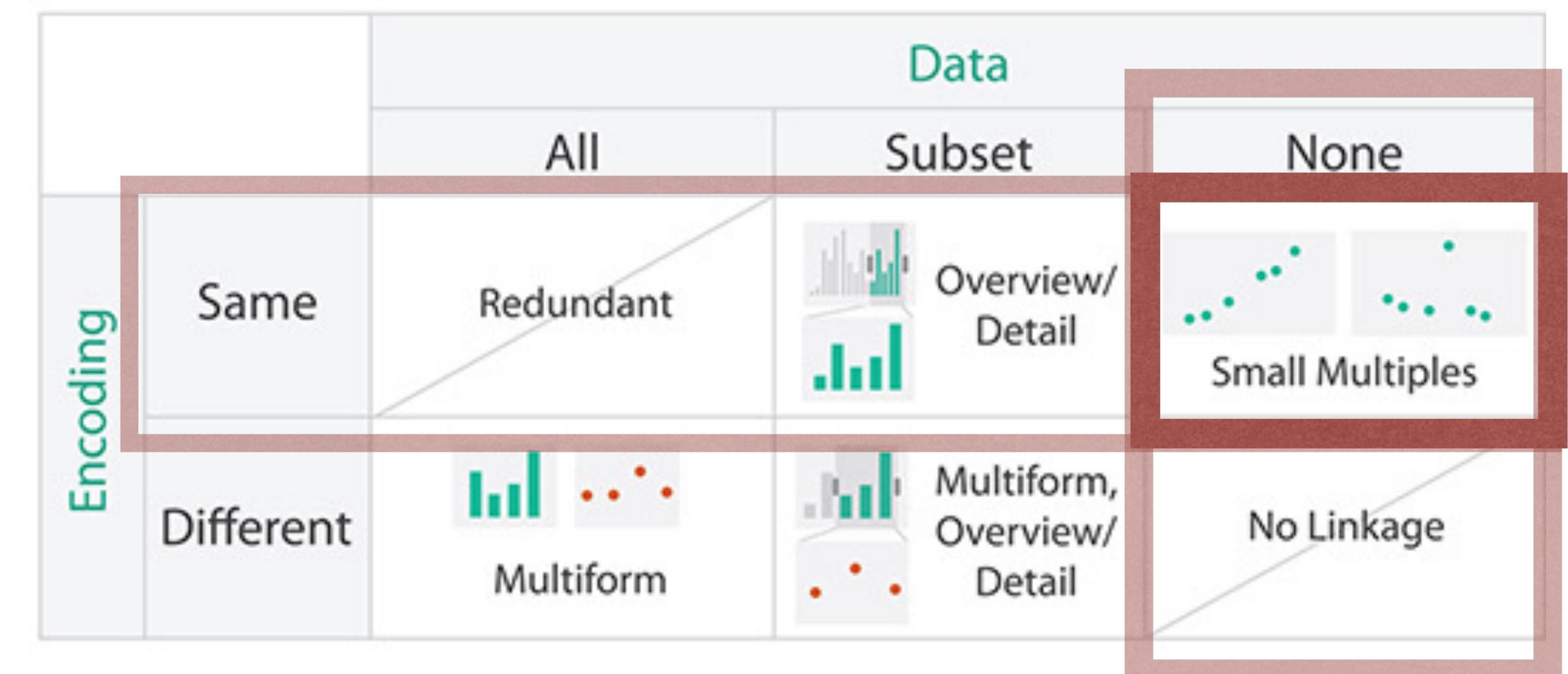
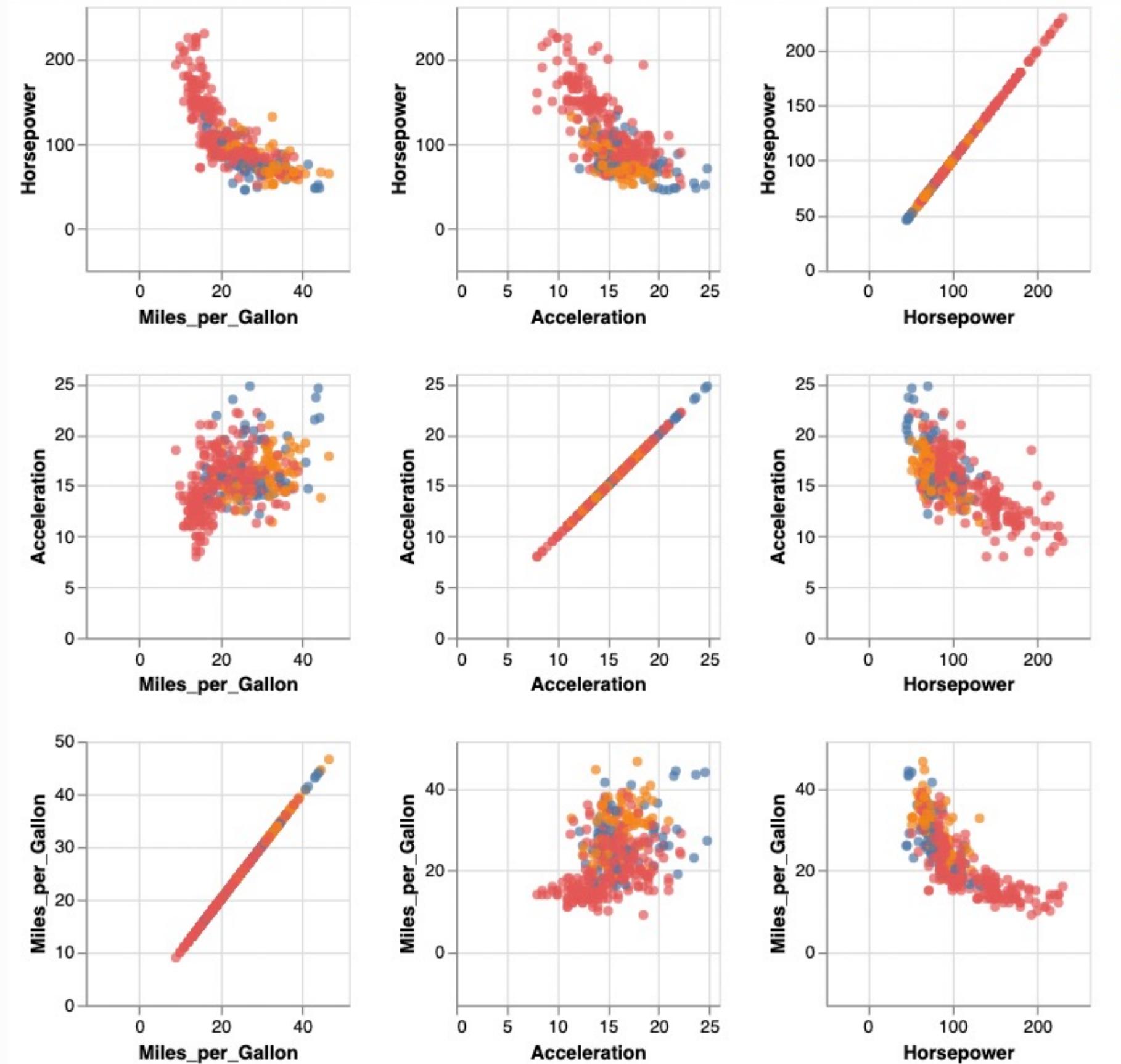
# Faceting

**Coordinate → Small Multiples**



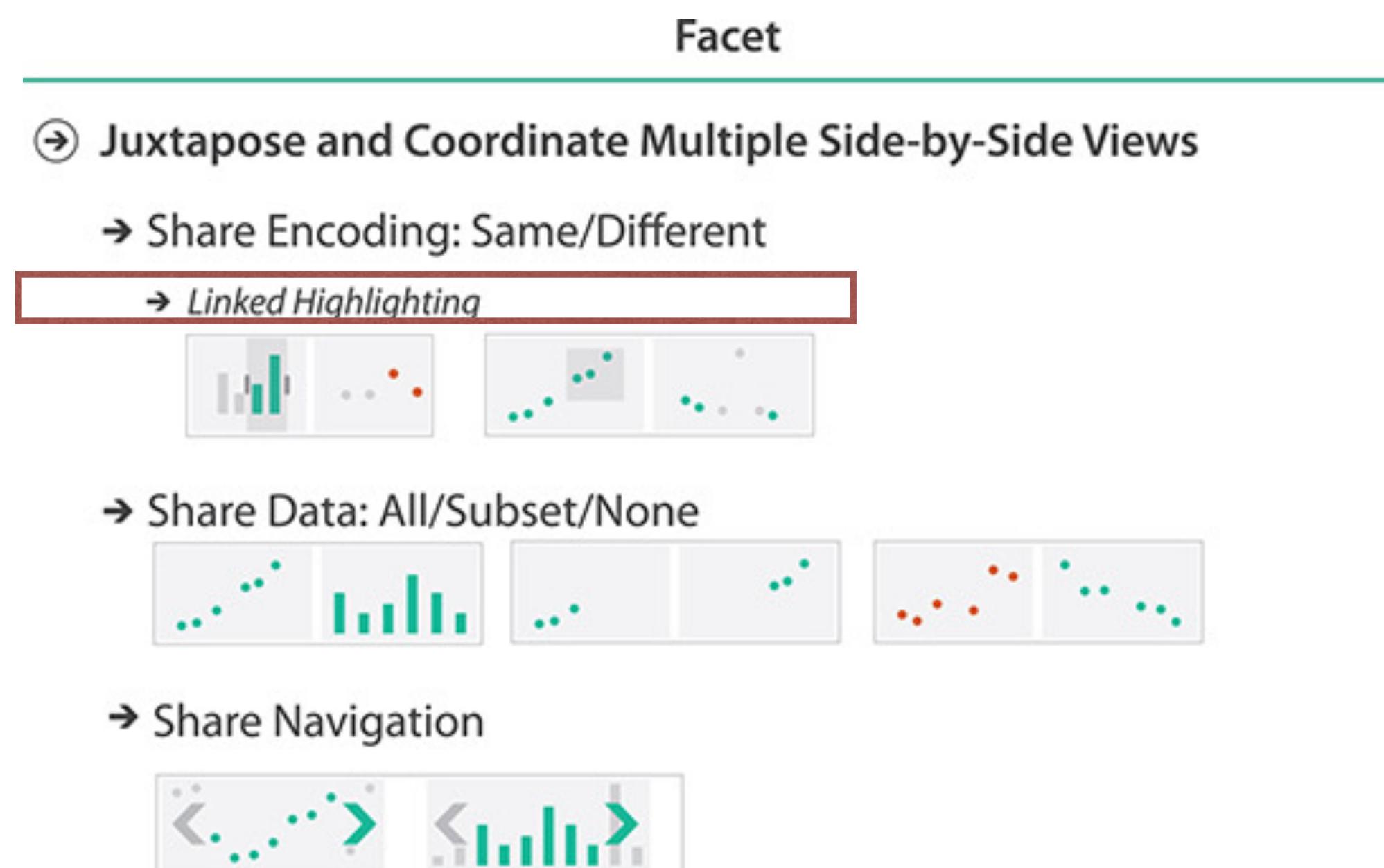
# Faceting

**Coordinate → Small Multiples**



# Faceting

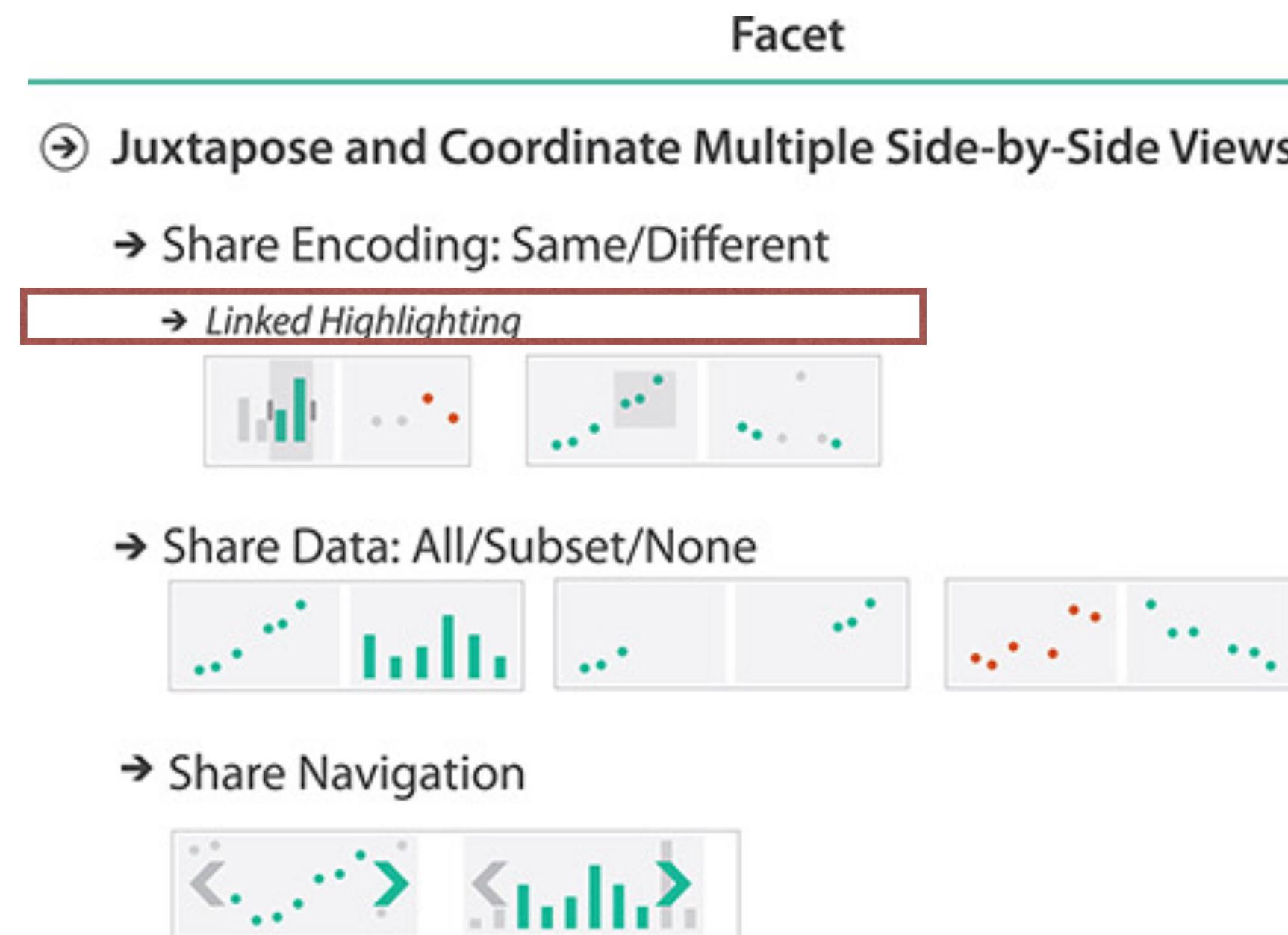
**Coordinate → Linked Highlighting**



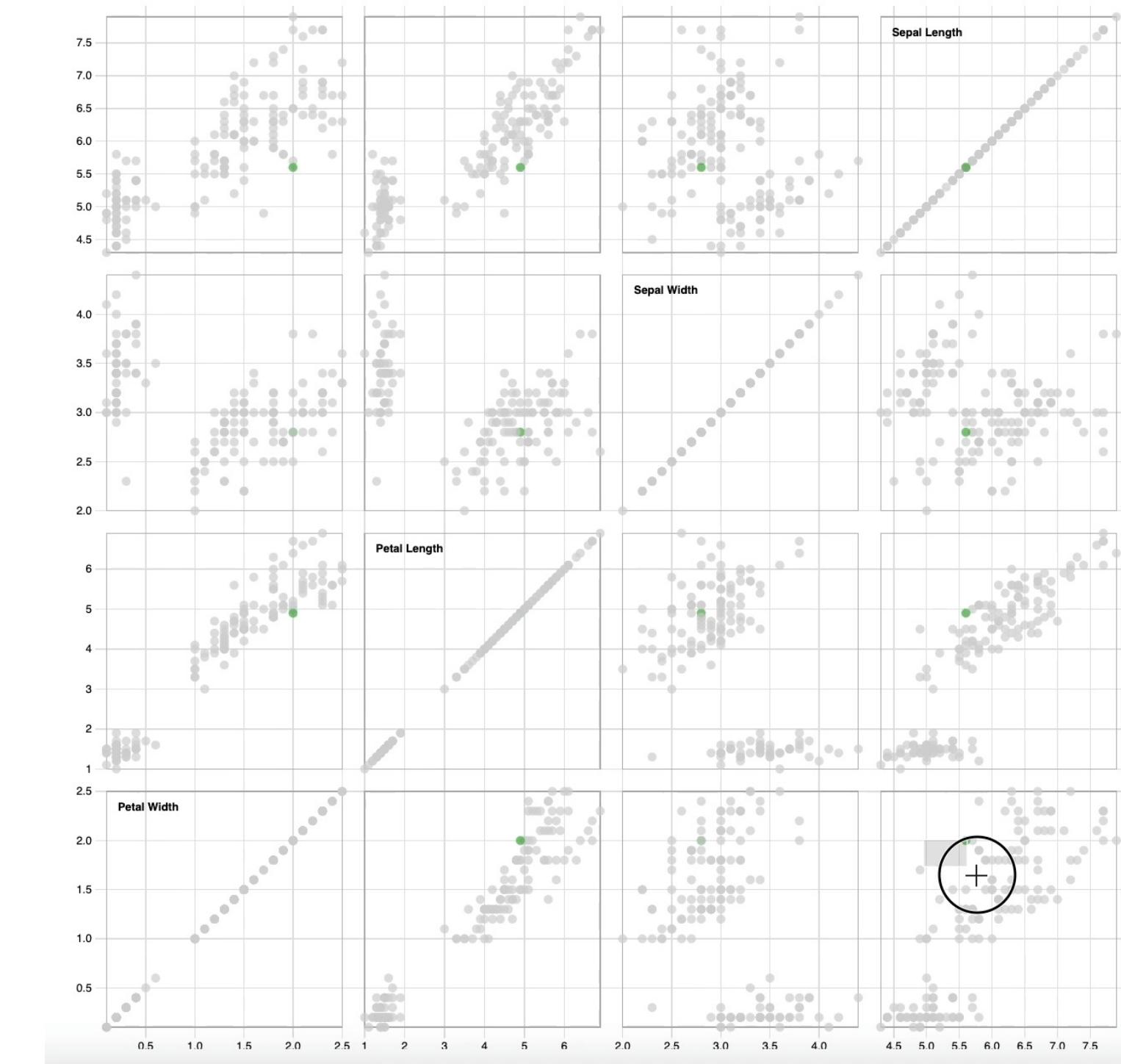
		All	Subset	None
Encoding	Same	Redundant	 Overview/ Detail	 Small Multiples
	Different	 Multiform	 Multiform, Overview/ Detail	No Linkage

# Brushing and Linking

## Coordinate → Brushing and Linking



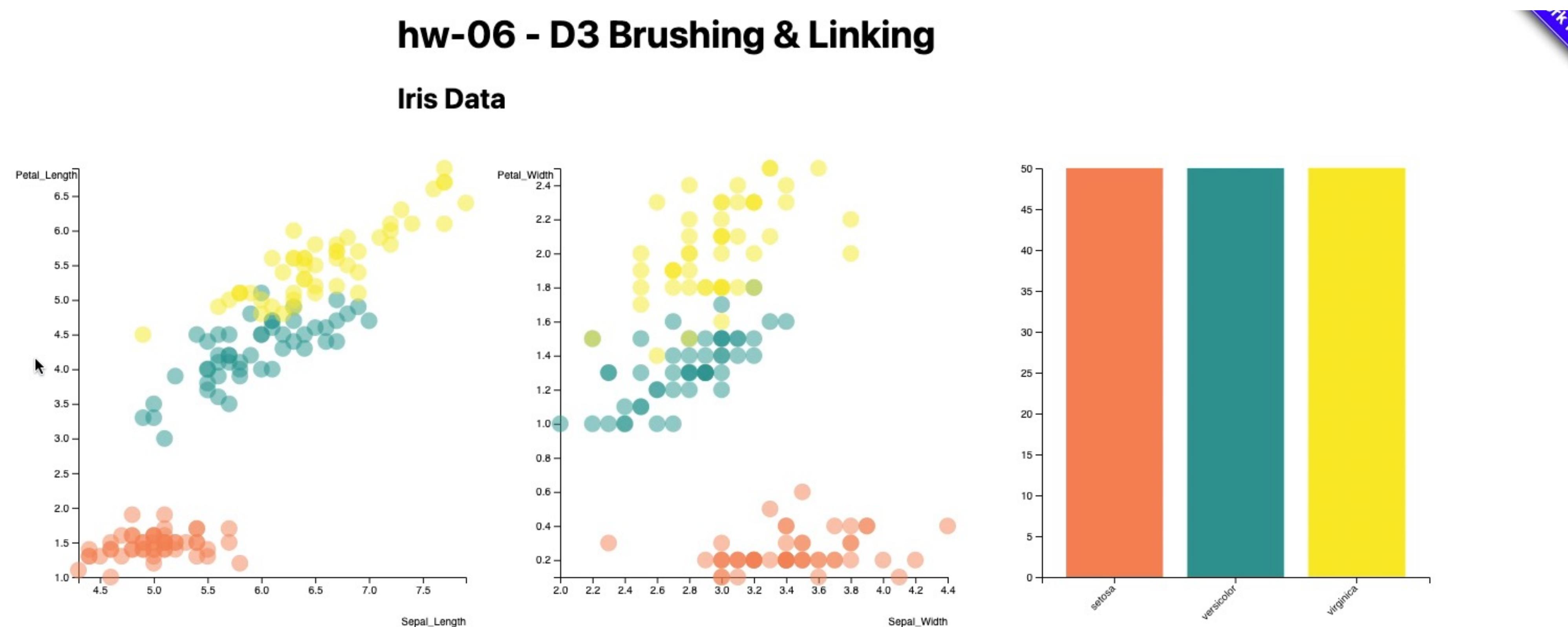
Scatterplot Matrix Brushing



<https://bl.ocks.org/mbostock/4063663>

# Brushing and Linking

**Coordinate → Brushing and Linking**



# Navigation

# Coordinate

Facet

## → Juxtapose and Coordinate Multiple Side-by-Side Views

→ Share Encoding: Same/Different

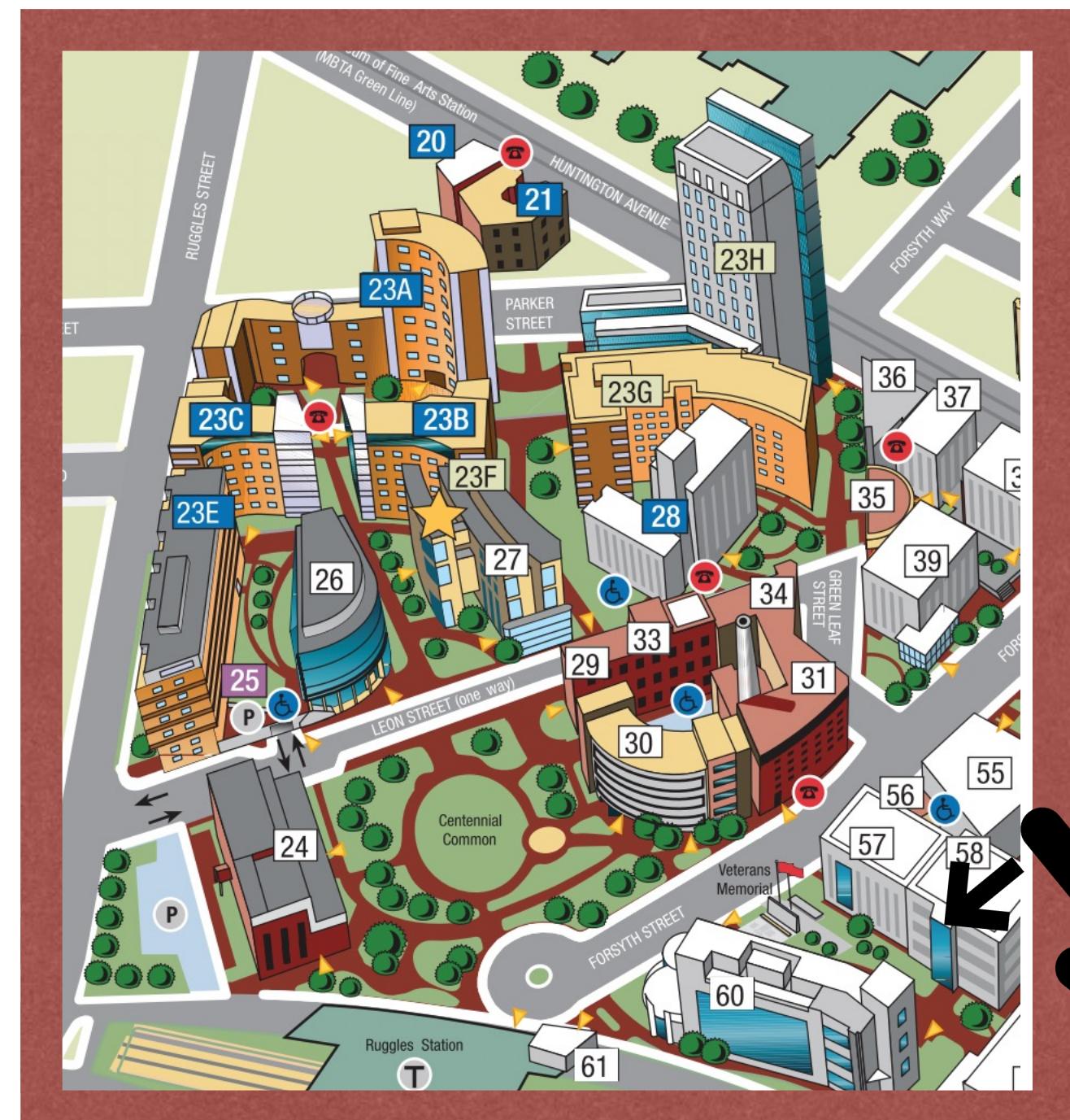
#### → *Linked Highlighting*



→ Share Data: All/Subset/None



→ Share Navigation



# Navigation

## Coordinate

### Facet

#### ④ Juxtapose and Coordinate Multiple Side-by-Side Views

→ Share Encoding: Same/Different

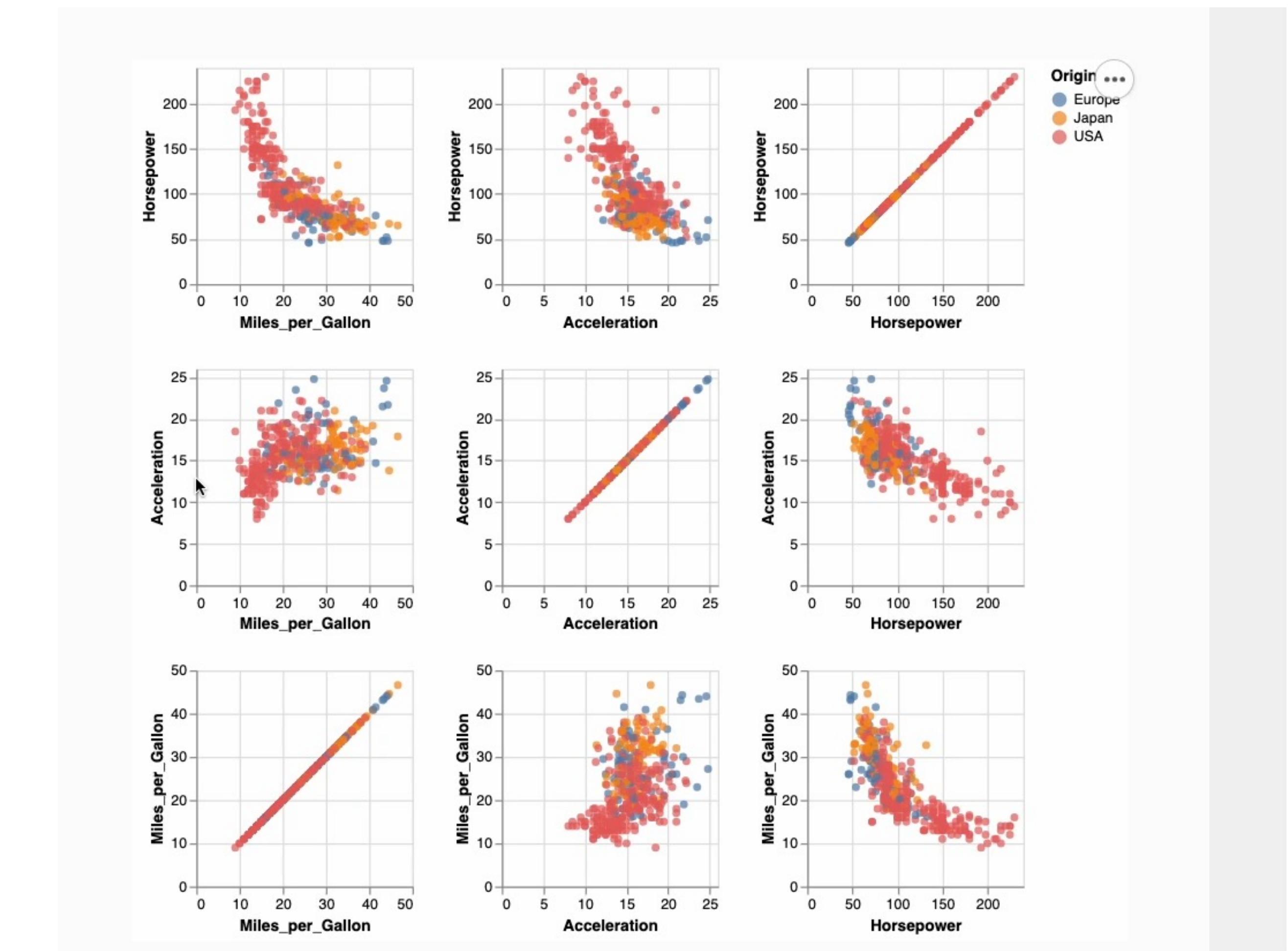
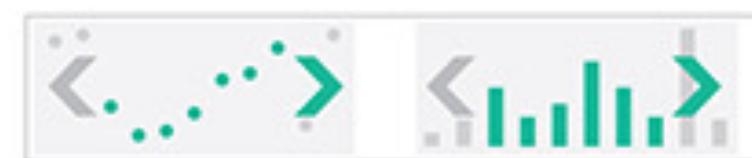
→ *Linked Highlighting*



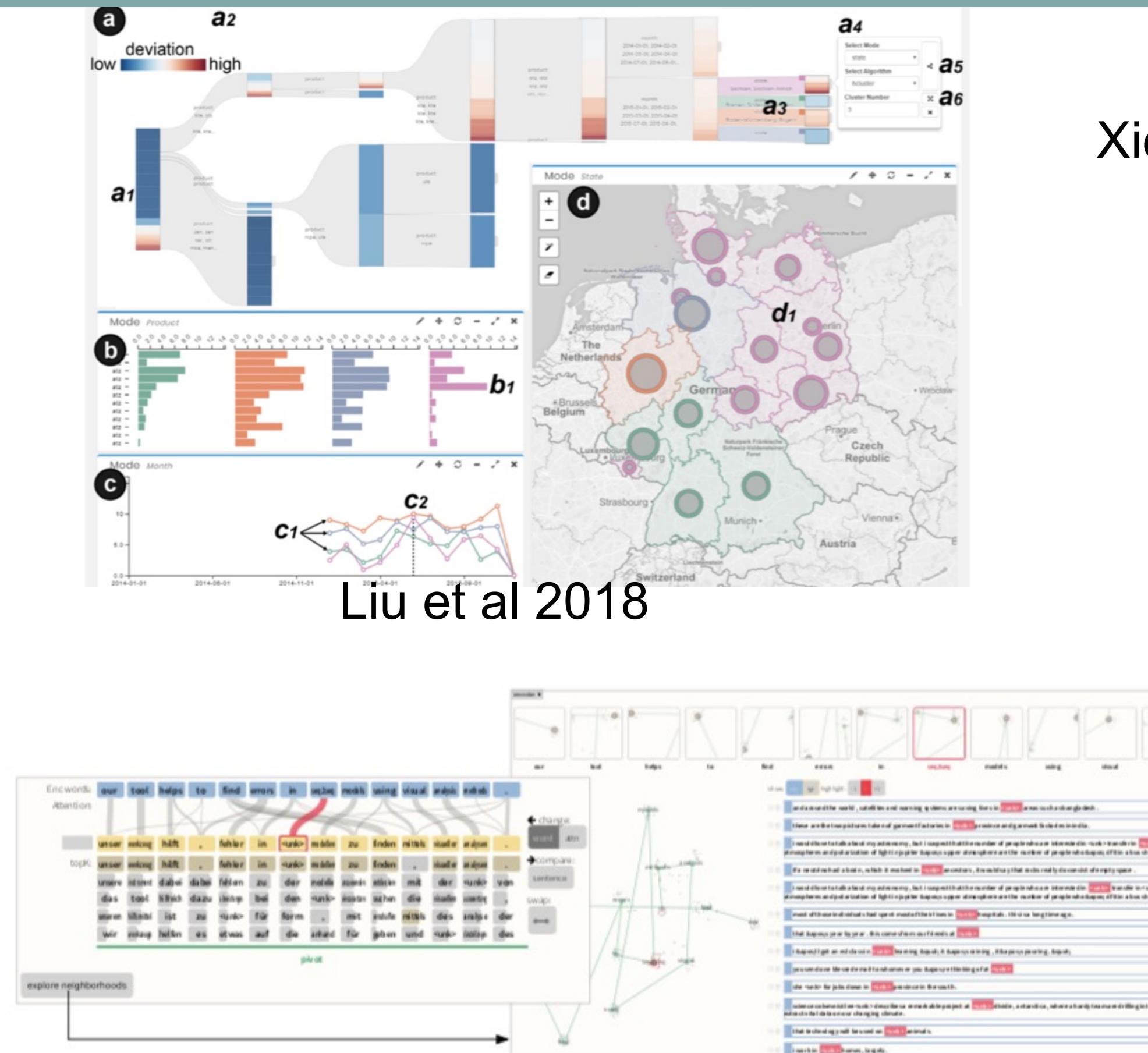
→ Share Data: All/Subset/None



→ Share Navigation

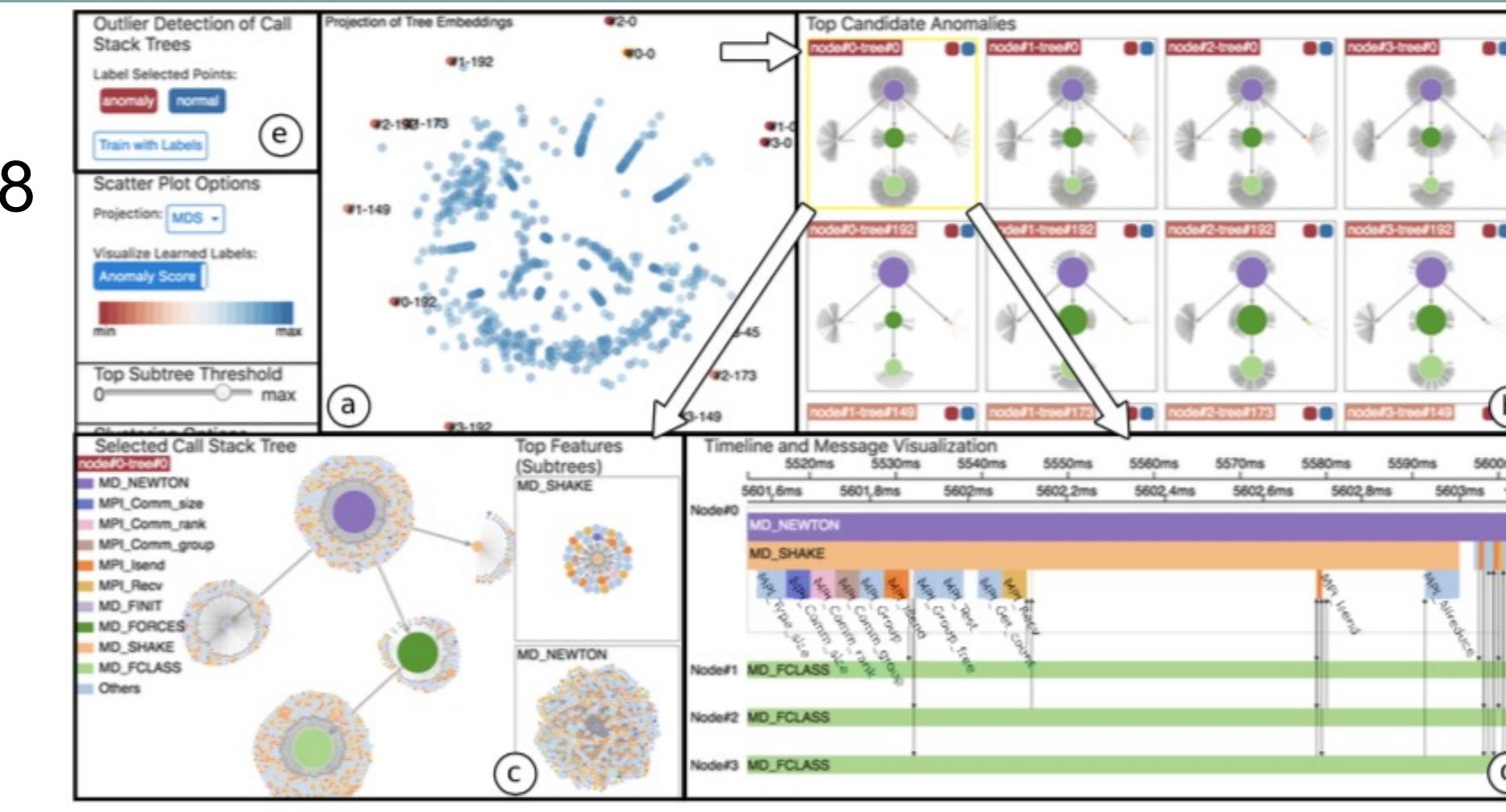


# Caveats



Strobelt and Gehrmann et al 2018

Xie et al 2018



Wang et al  
2018



Let's take a break! Stretch, go for  
a walk, be social ☺  
Be back here in 10 mins.

# Summary

## **Today we:**

- Reviewed Interaction
- Reviewed Faceting

**ic-10 is DUE today.**

**hw-06 is DUE before next class.**