

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

Reminders / Notes

- Ab is out of town for a conference next week
- You will have a larger than usual pm assignment, knowing that you have class time to work on it
- The pm will be due Friday at 11:59pm
- If you would like to know your mid-semester grade you can ask at the end of class today or send me an email

Last Class

We:

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

Any Questions?

Today

- Review Interaction
- Review Faceting

INTERACTION

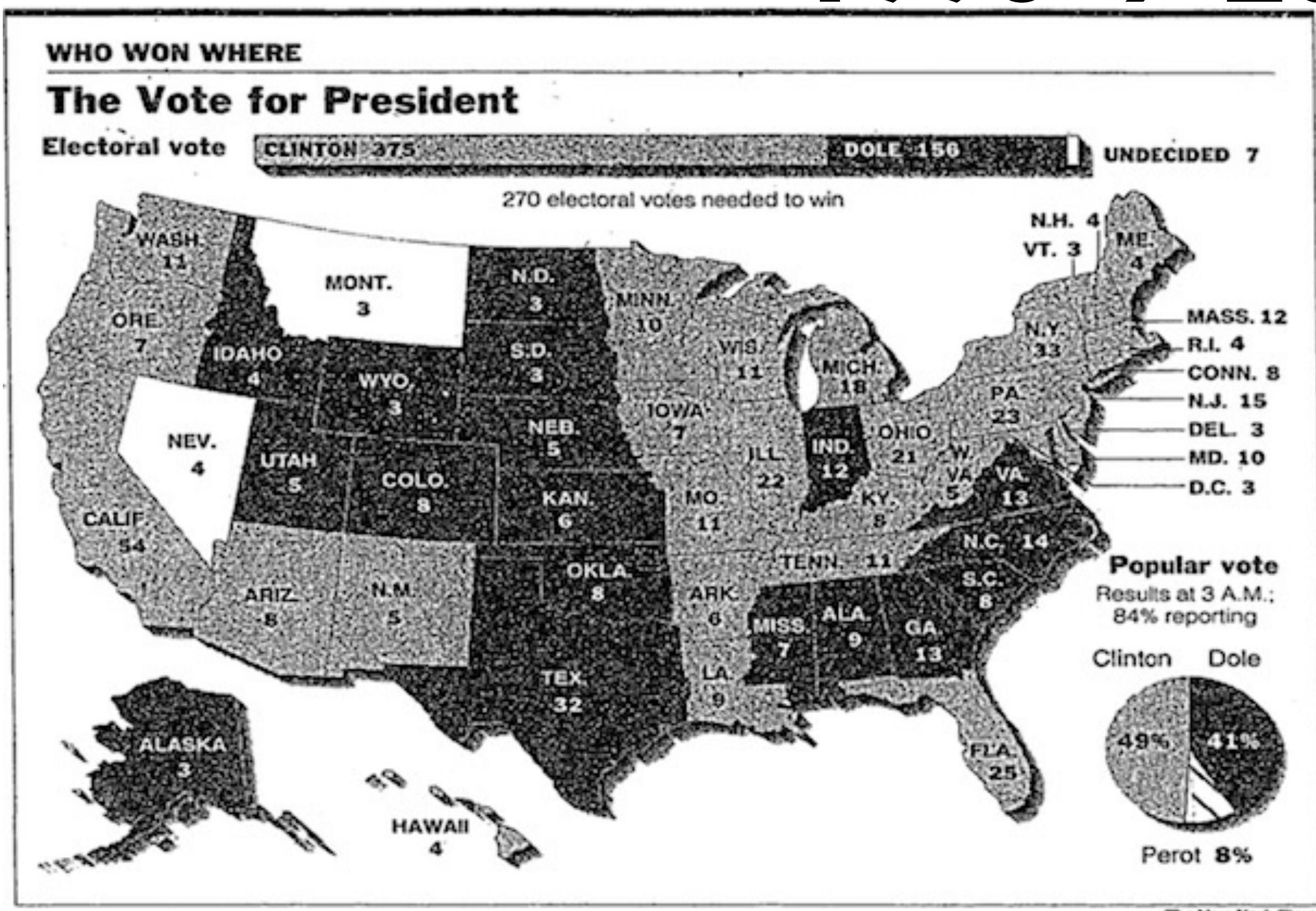
Interaction

Benefits of Interaction

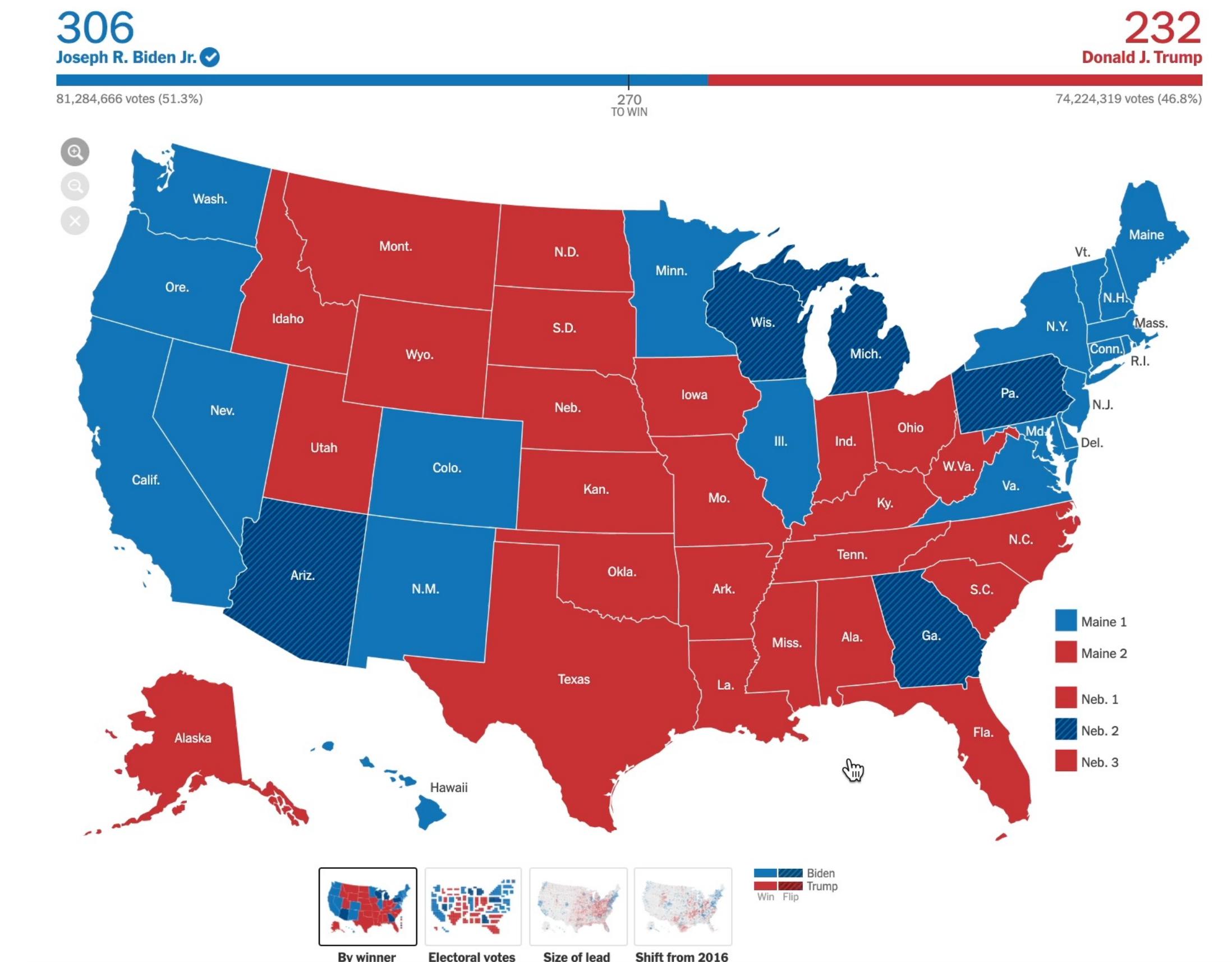
- Enables visualization of large amounts of data
- Amplifies user cognition (supports sensemaking)
- Increases engagement (vis becomes personal to user)
- Increases deep learning and learning transfer

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

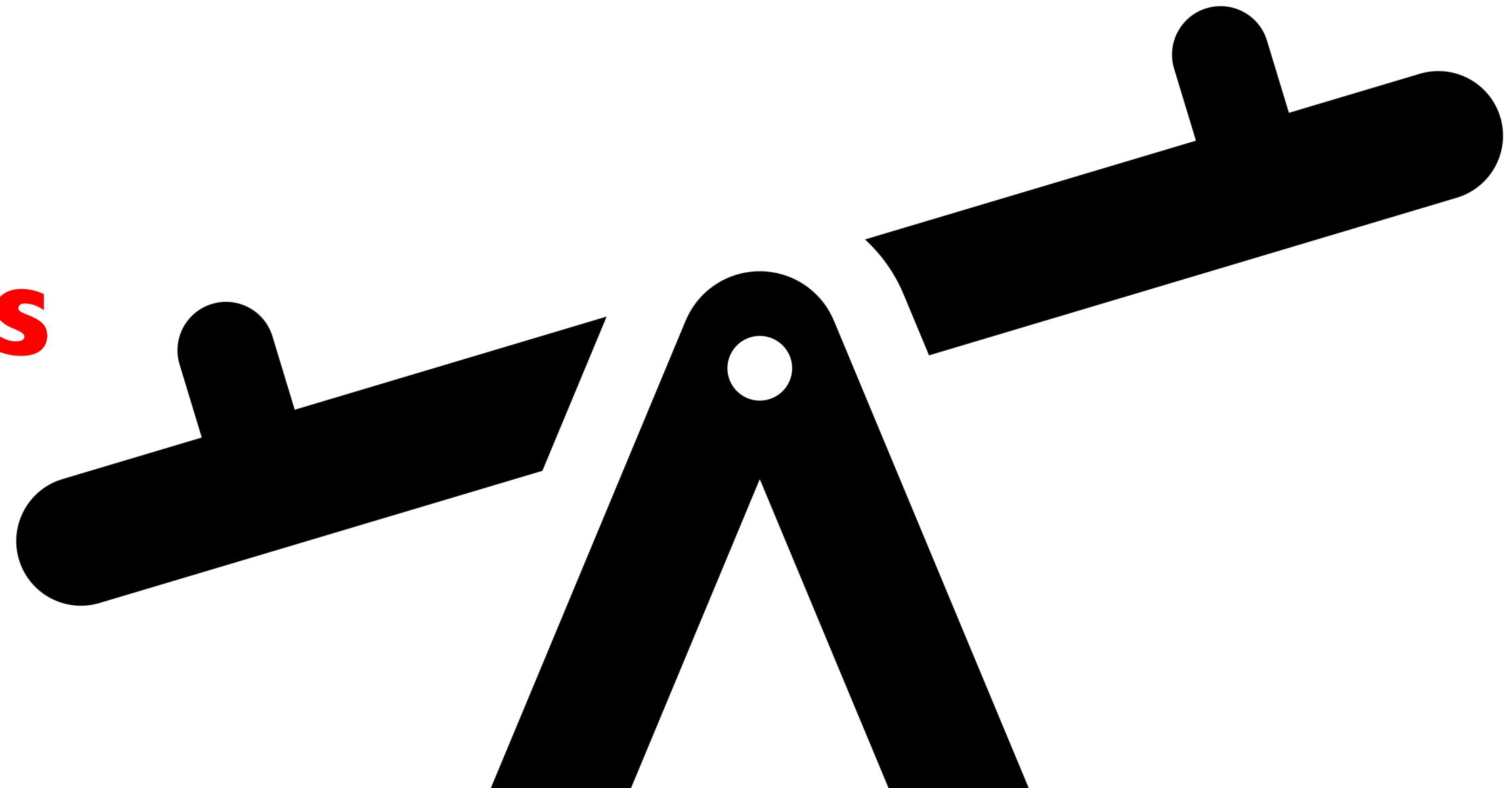
Caveats of Interaction

- 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)

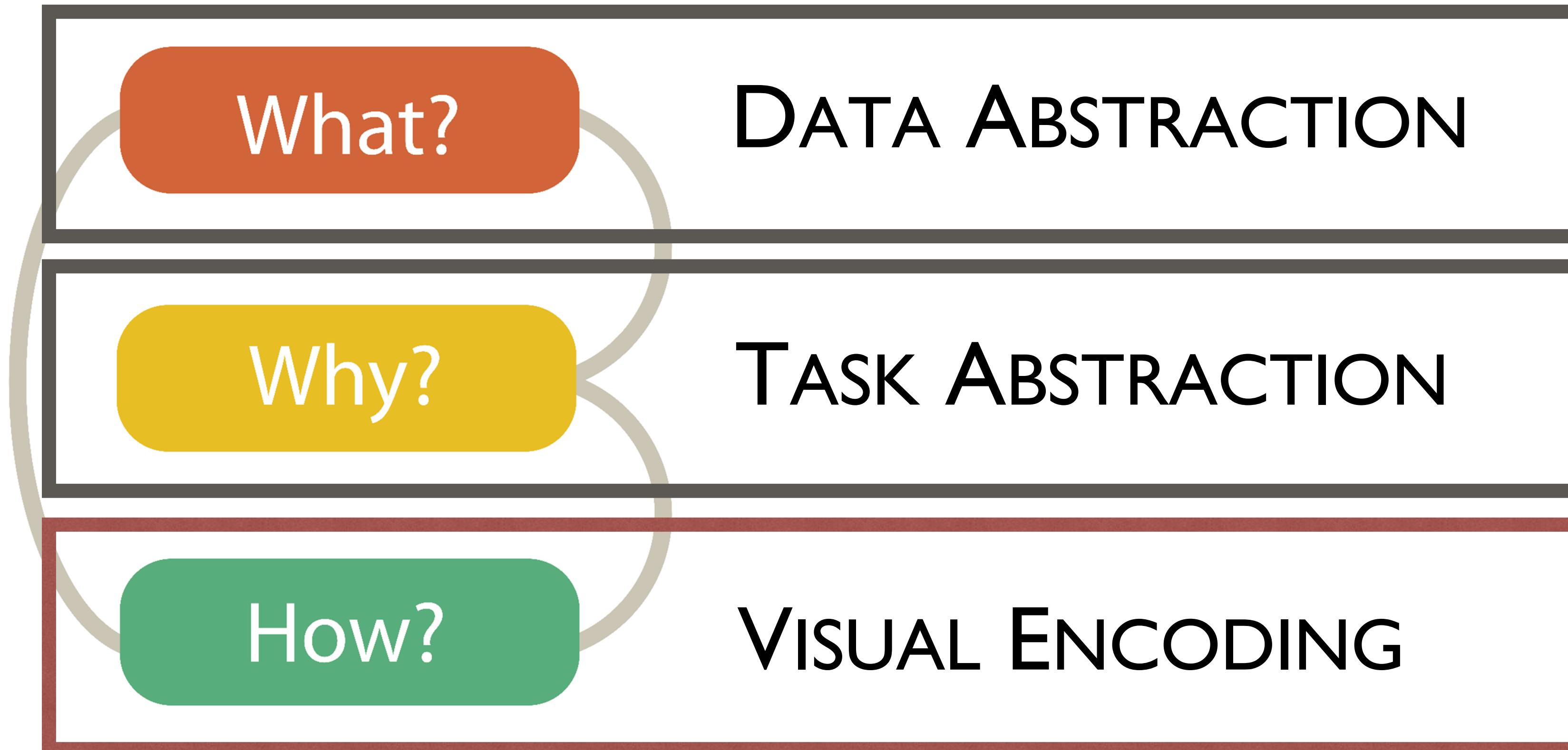
Interaction

Costs

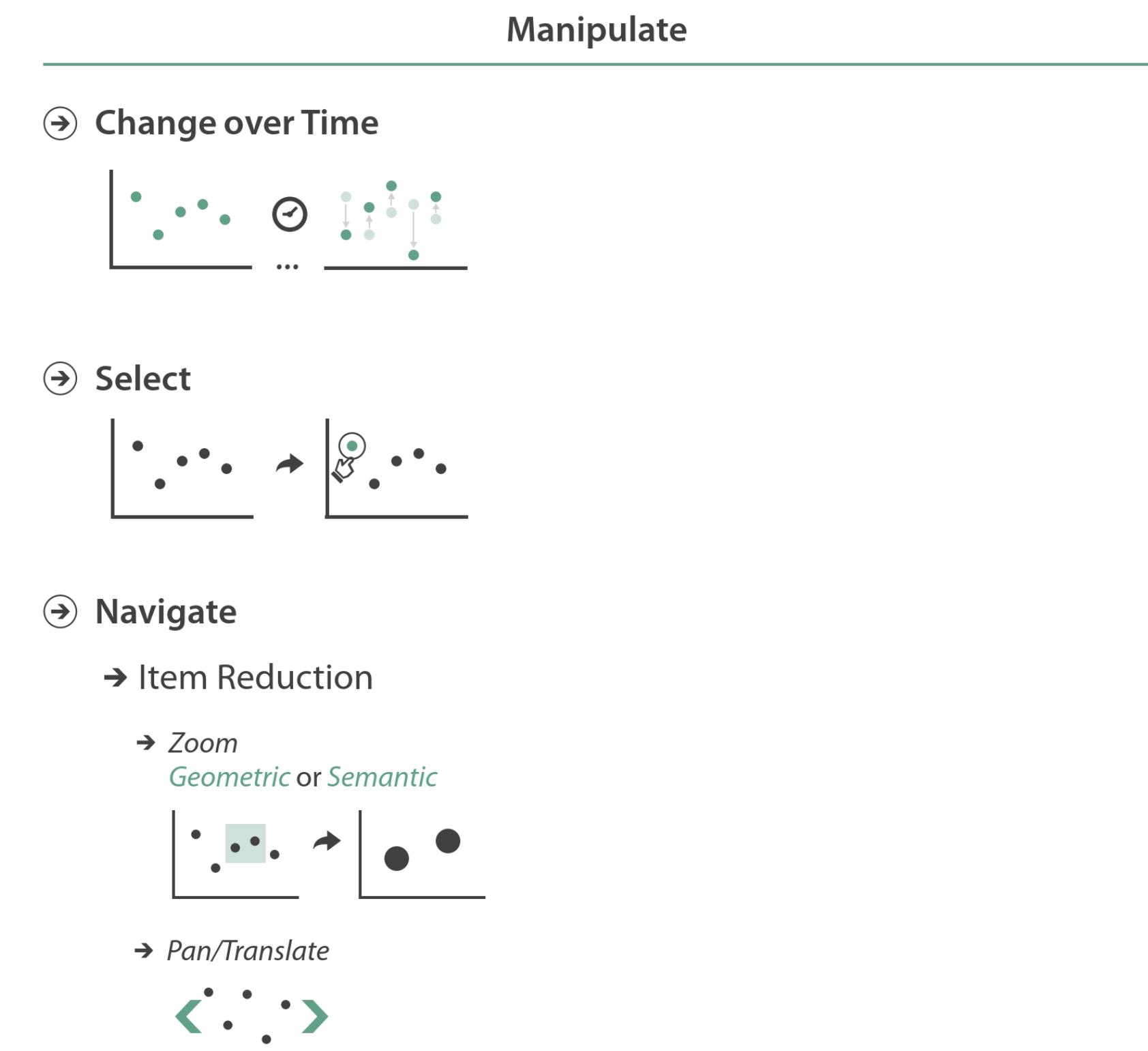
Benefits



Visualization Building Blocks



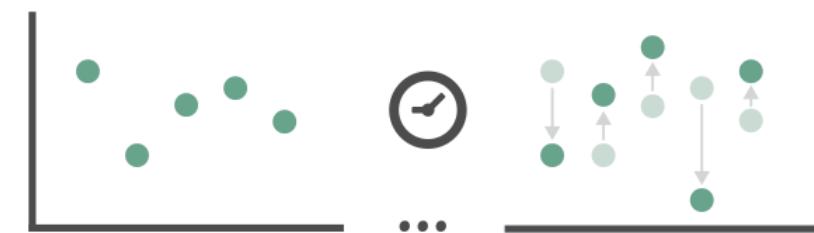
Interaction Taxonomies: Munzner



Interaction Taxonomies: Munzner

Change over time

→ Change over Time



Example: D3

Animated
Transitions

flexible transitions

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

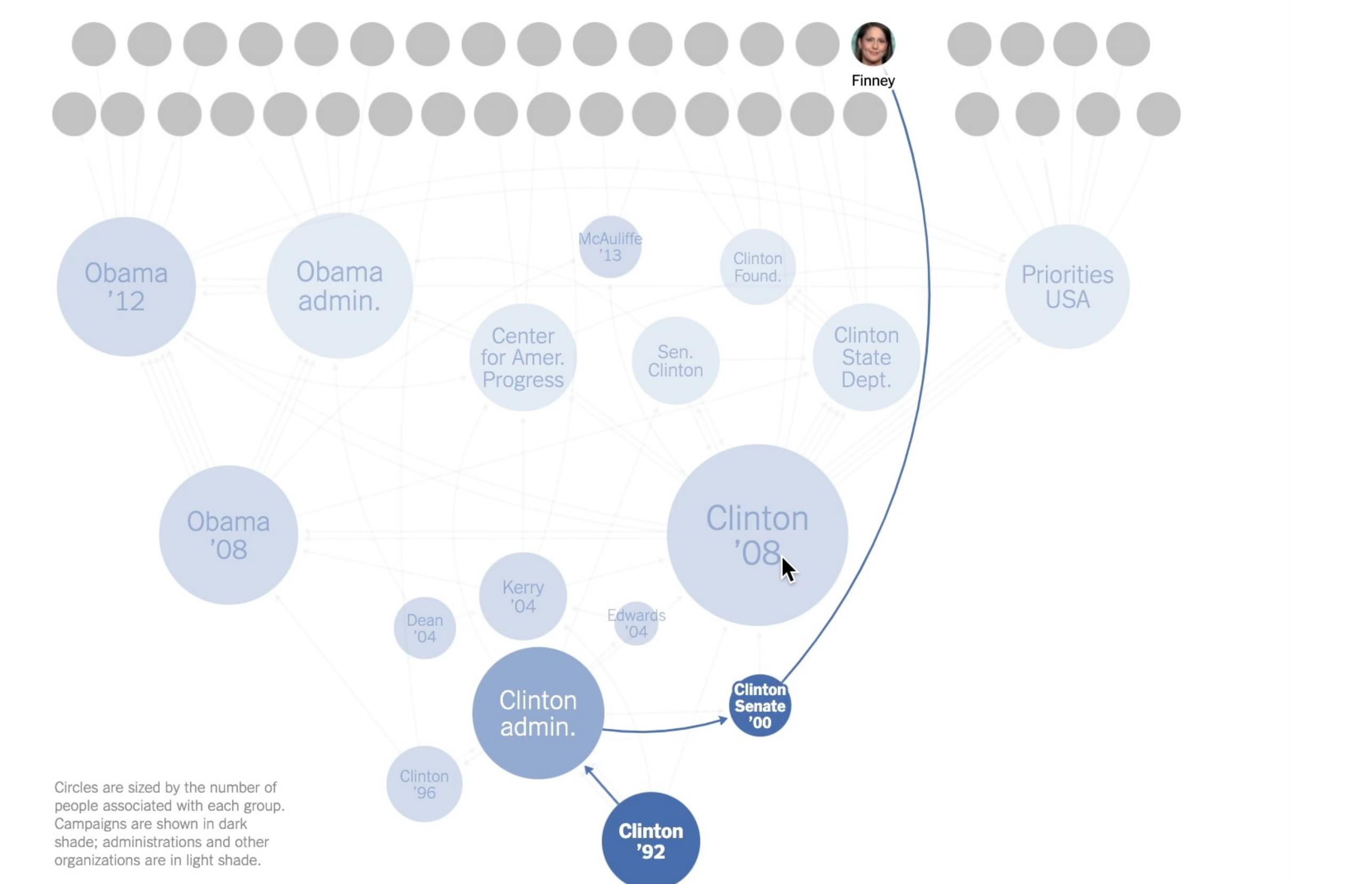
Interaction Taxonomies: Munzner

Selection

④ Select



Example: NYT
Campaign
Connections

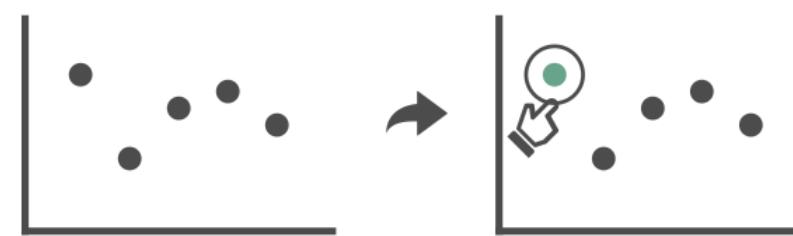


<http://www.nytimes.com/interactive/2015/05/17/us/elections/2016-presidential-campaigns-staff-connections-clinton-bush-cruz-paul-rubio-walker.html>

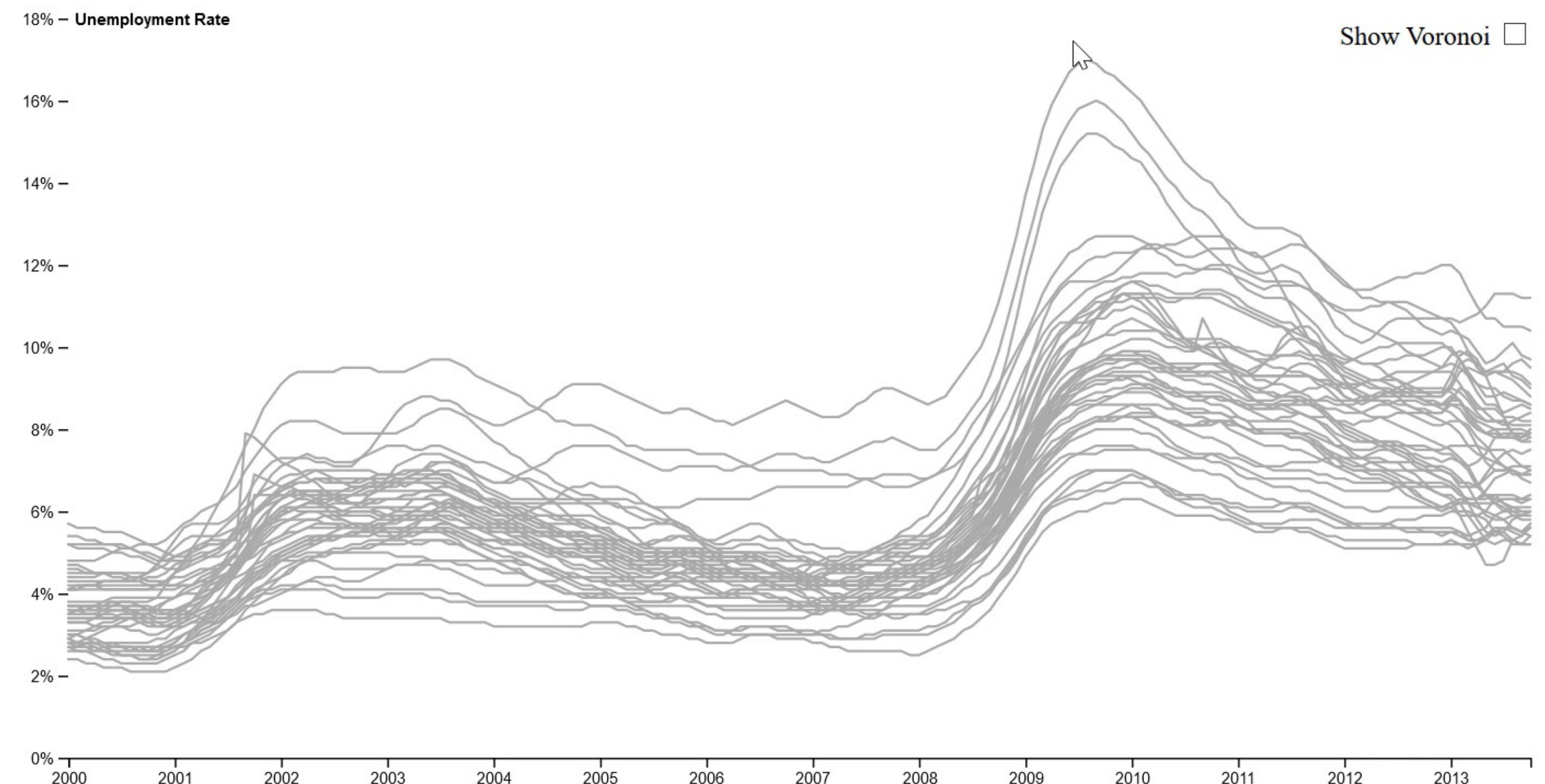
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Selection

④ Select



Example:
Voronoi
Cursors



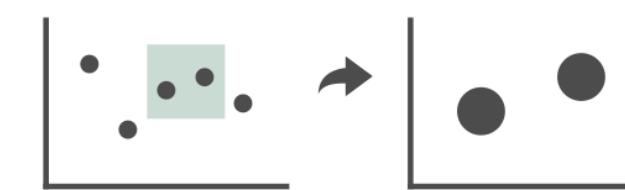
Interaction Taxonomies: Munzner

Navigate

④ Navigate

→ Item Reduction

→ Zoom
Geometric or Semantic



→ Pan/Translate

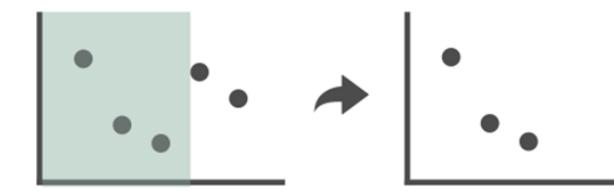


→ Attribute Reduction

→ 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

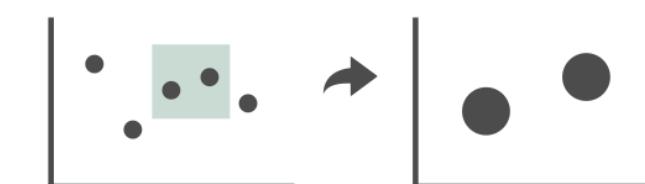
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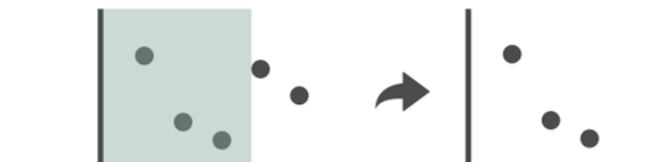


→ Attribute Reduction

→ Slice



→ Cut



→ Project



Filtering and Aggregation

Items

Attributes

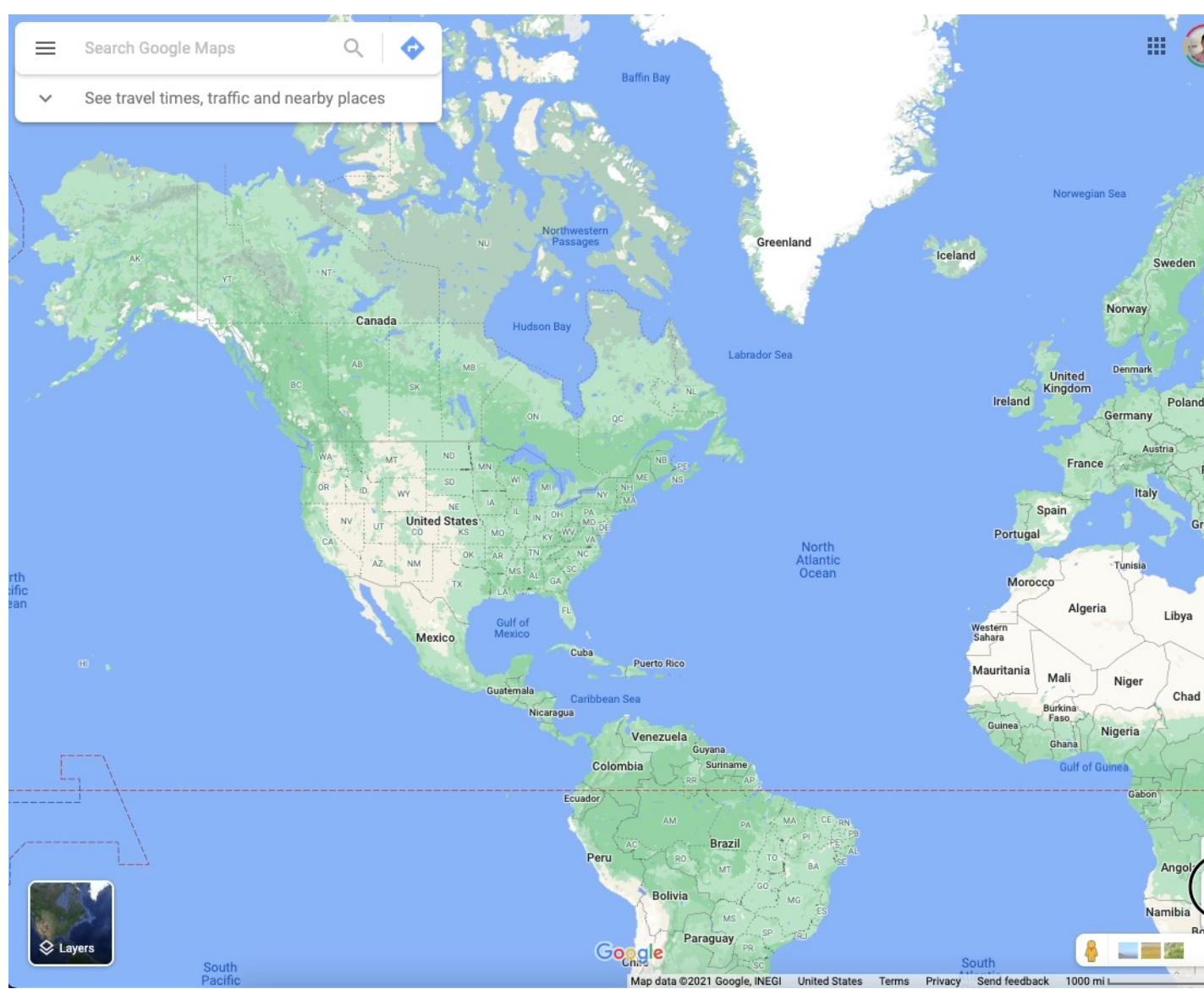
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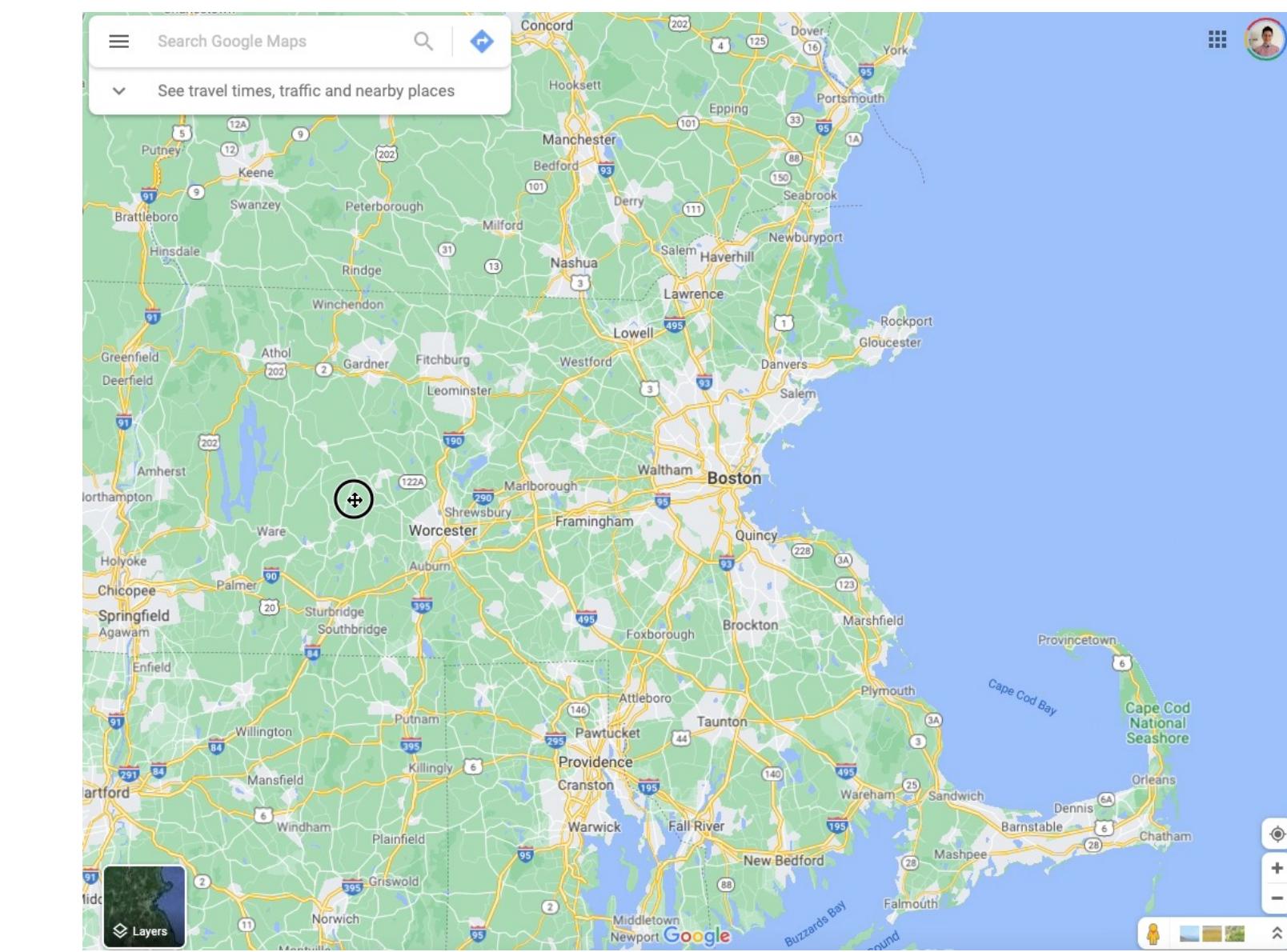
Navigate → Item reduction → Pan/Zoom

→ Zoom

Geometric or Semantic

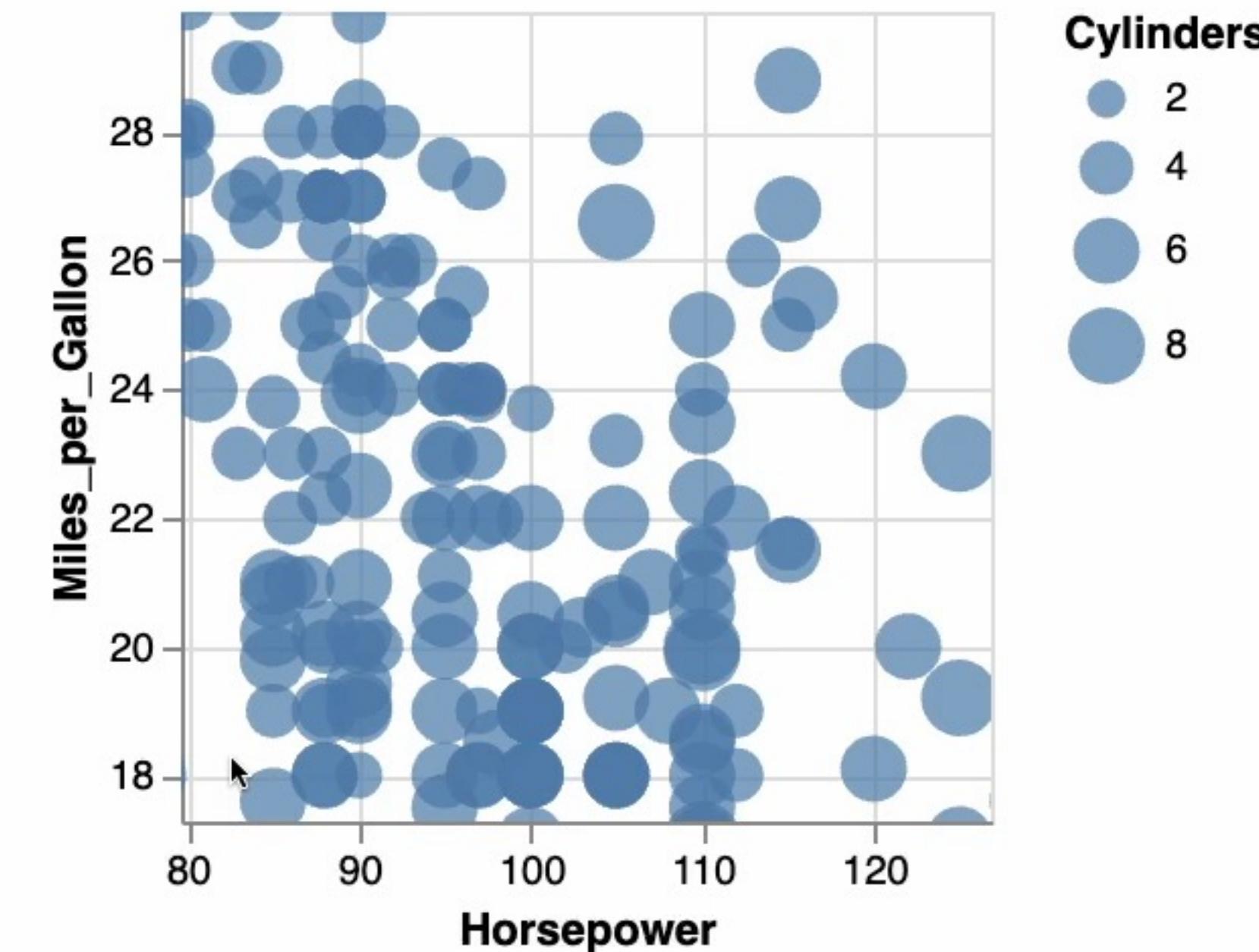
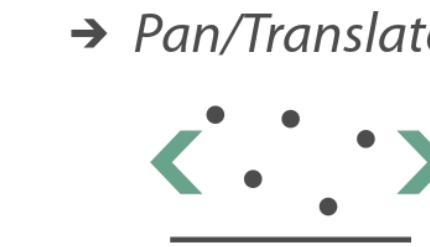
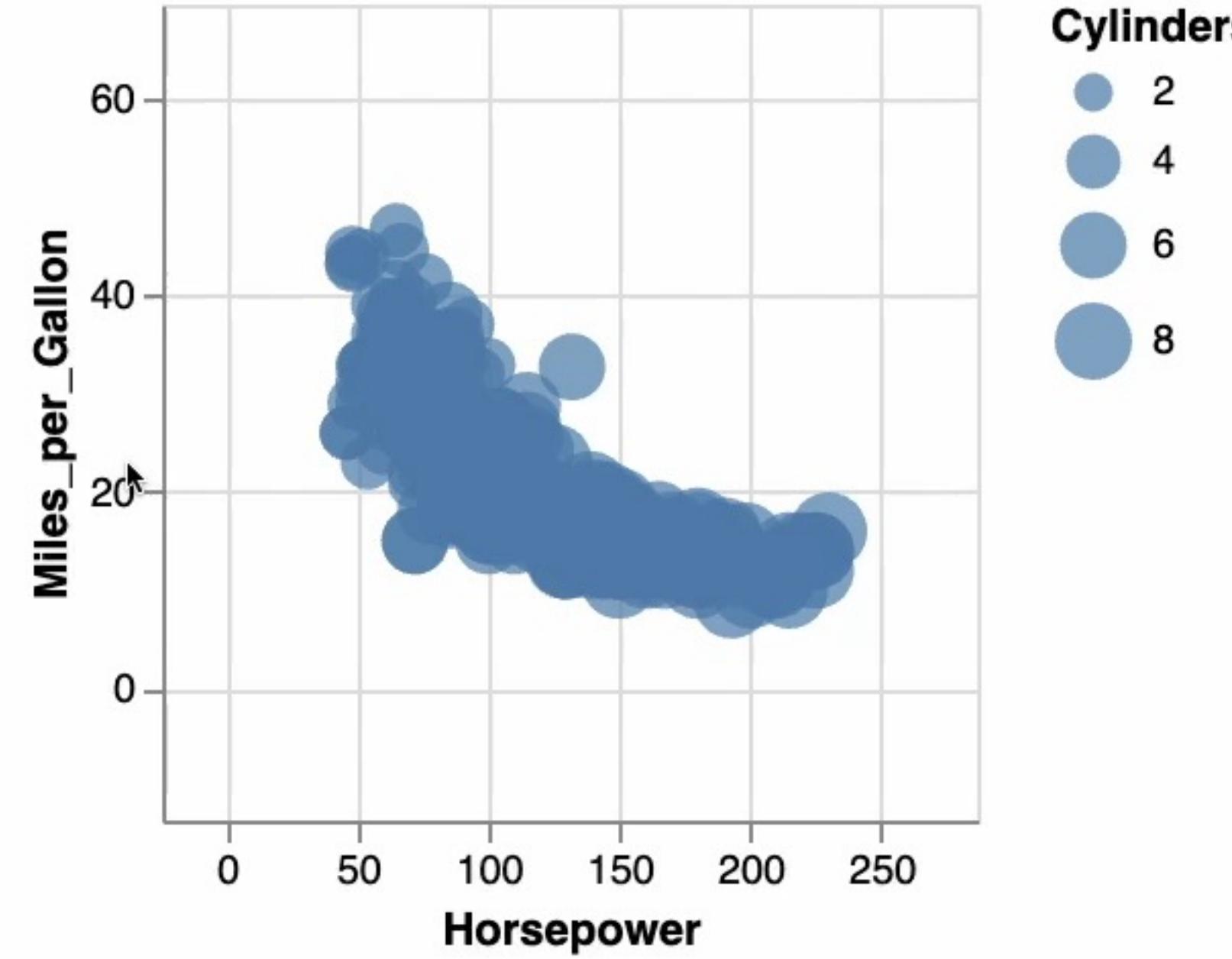
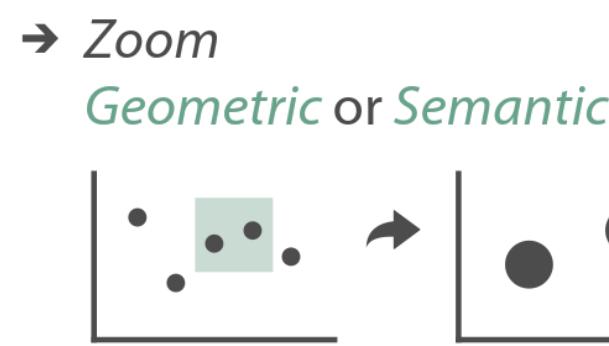


→ Pan/Translate



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

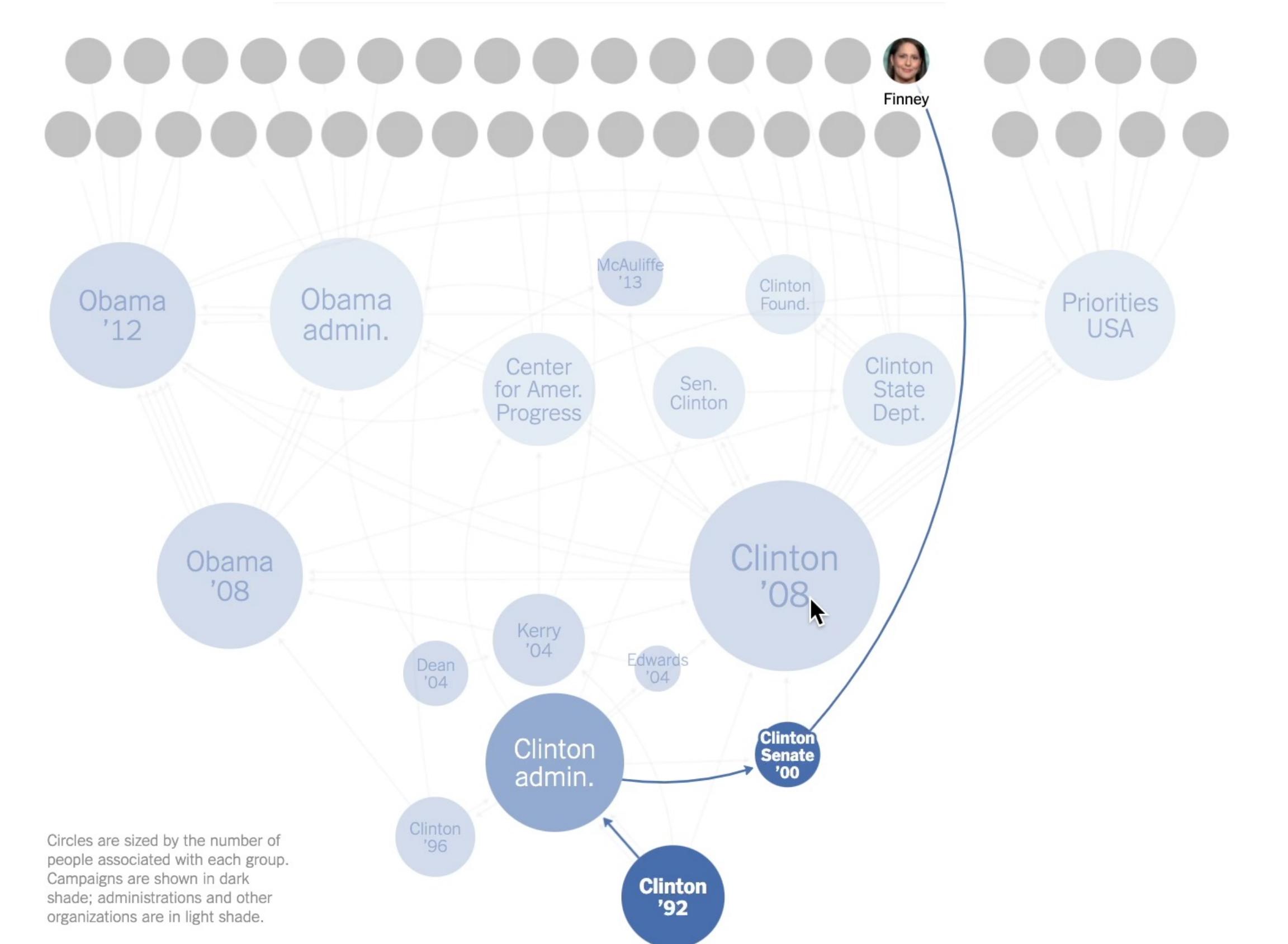
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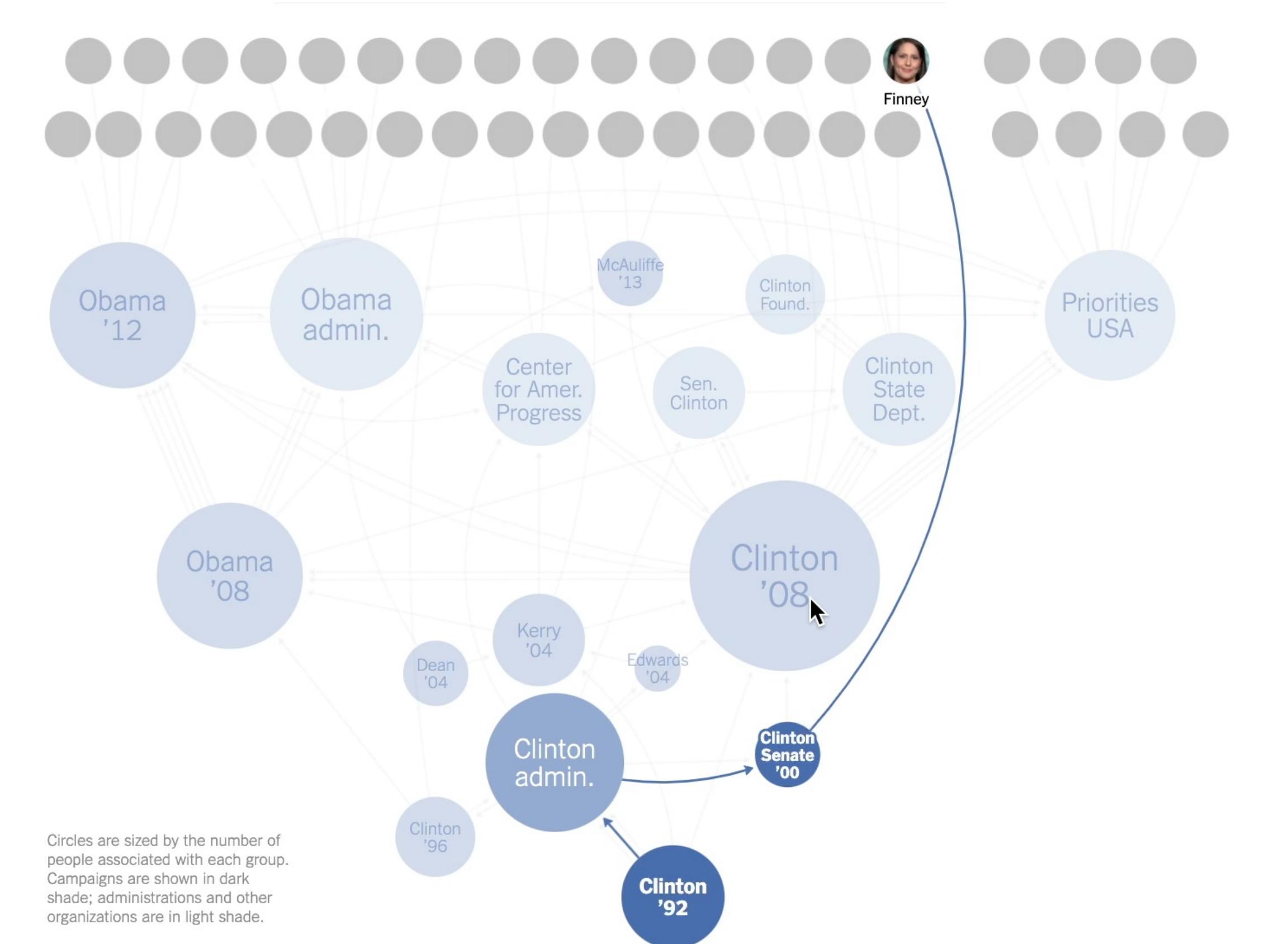
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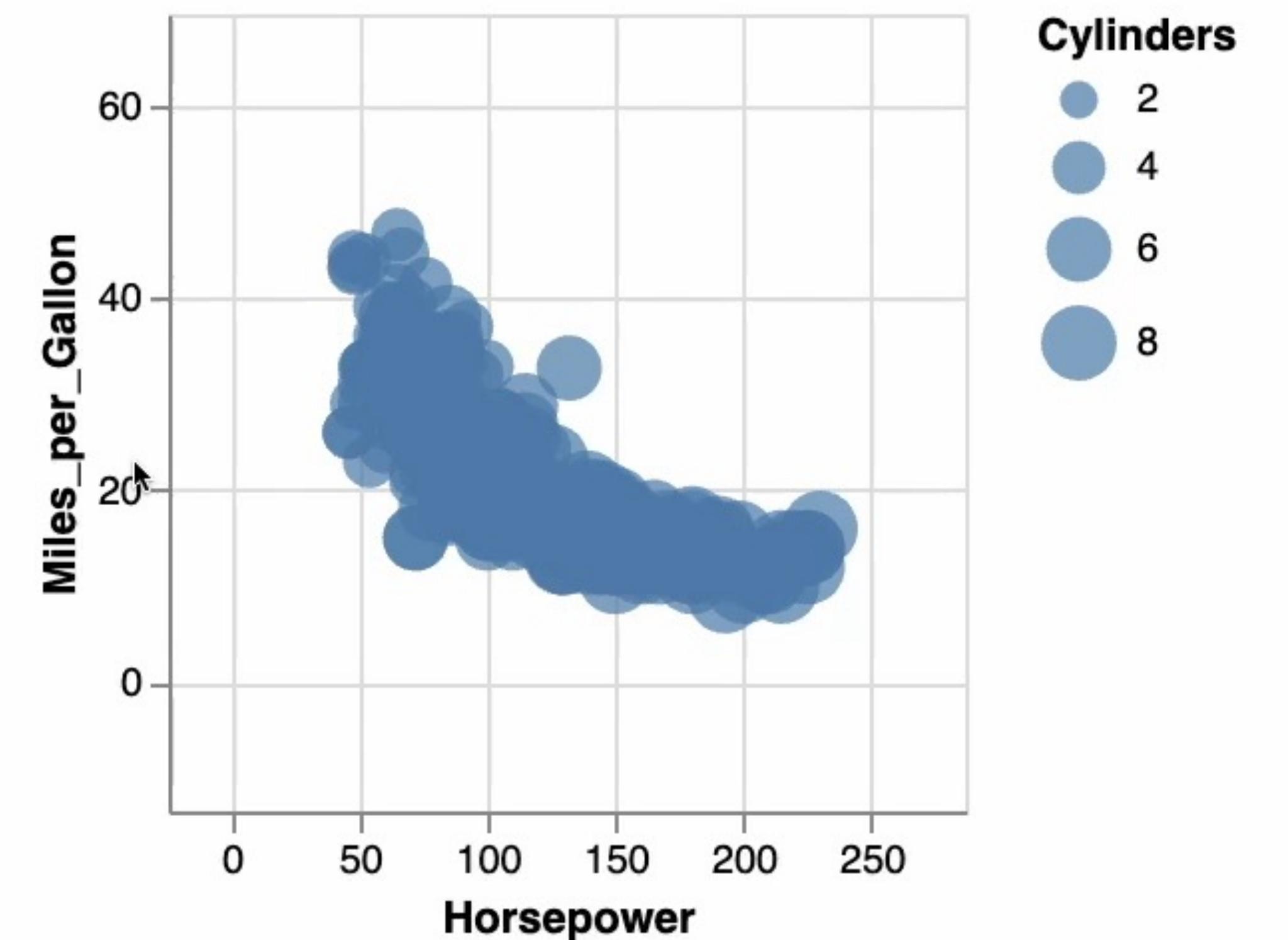
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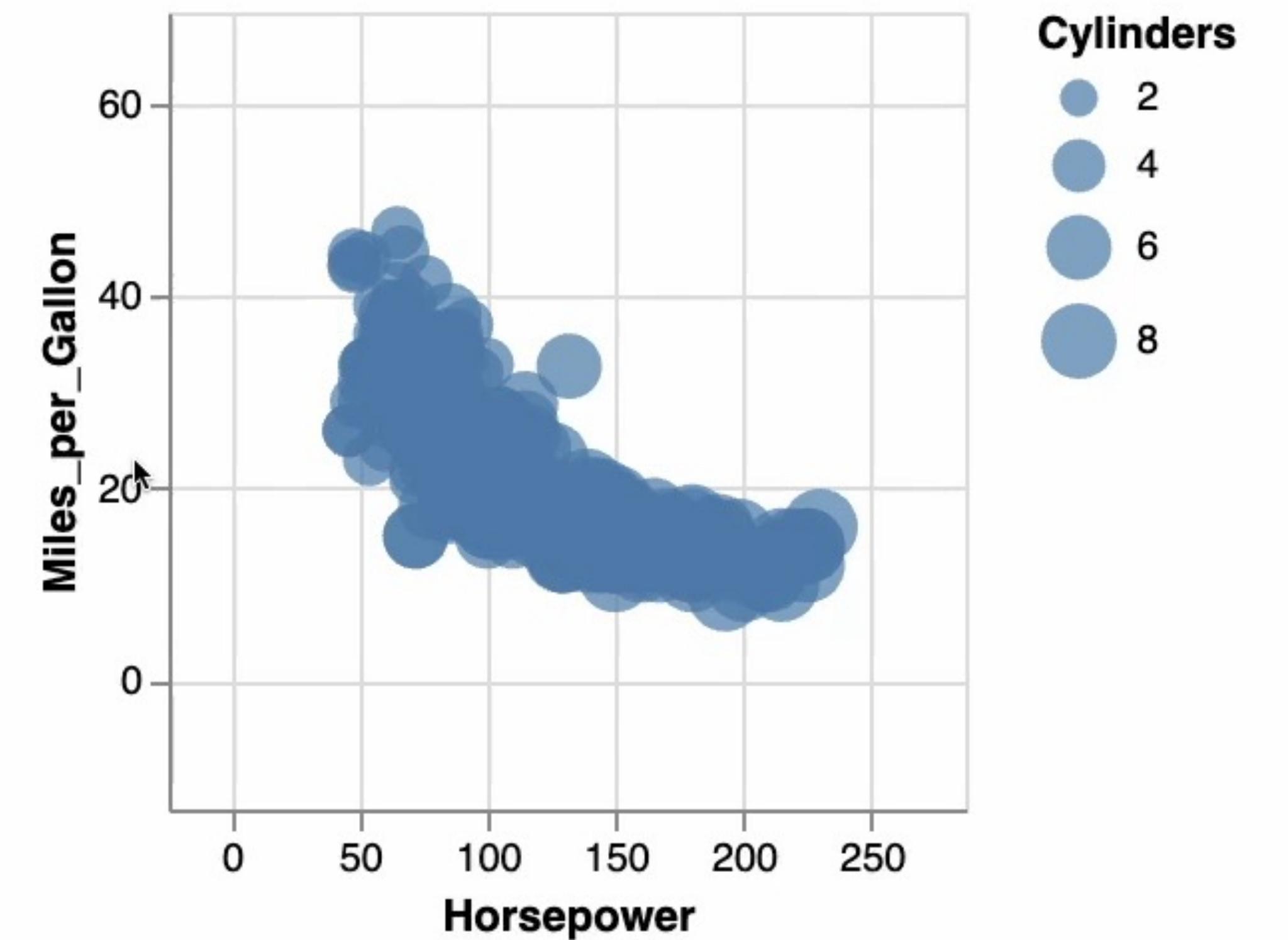
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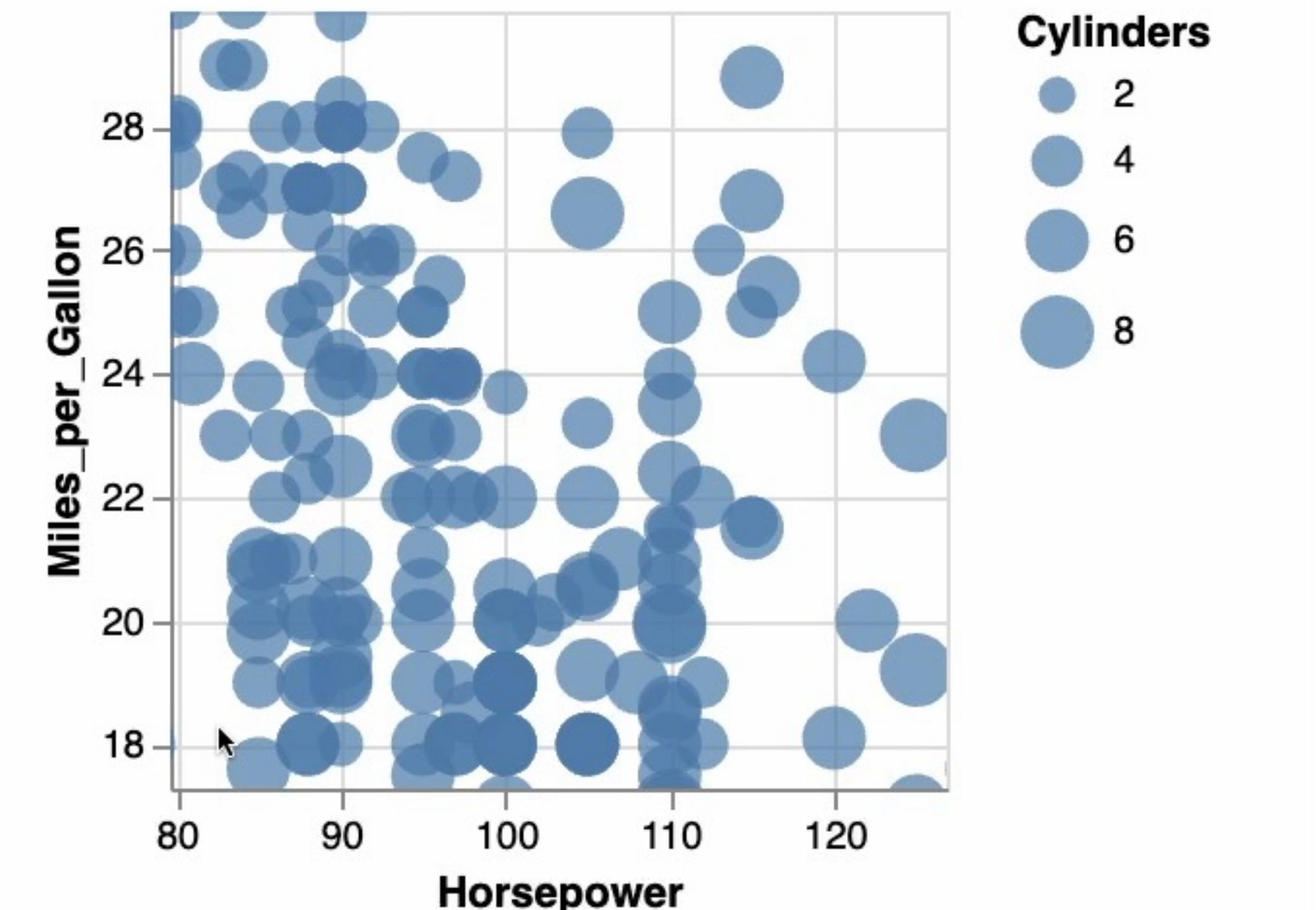
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https://vega.github.io/vega-lite/examples/selection_translate_scatterplot_drag.html

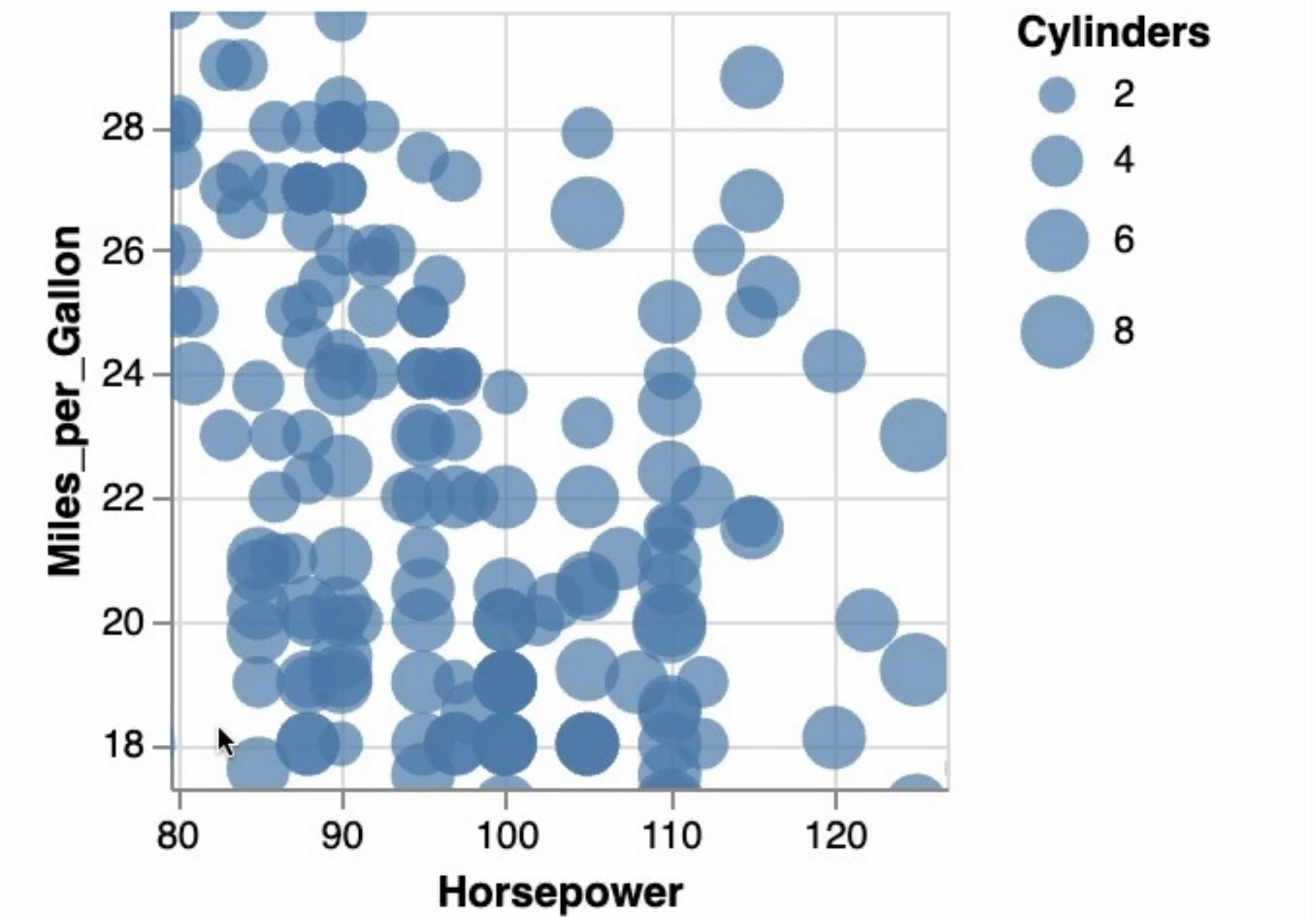
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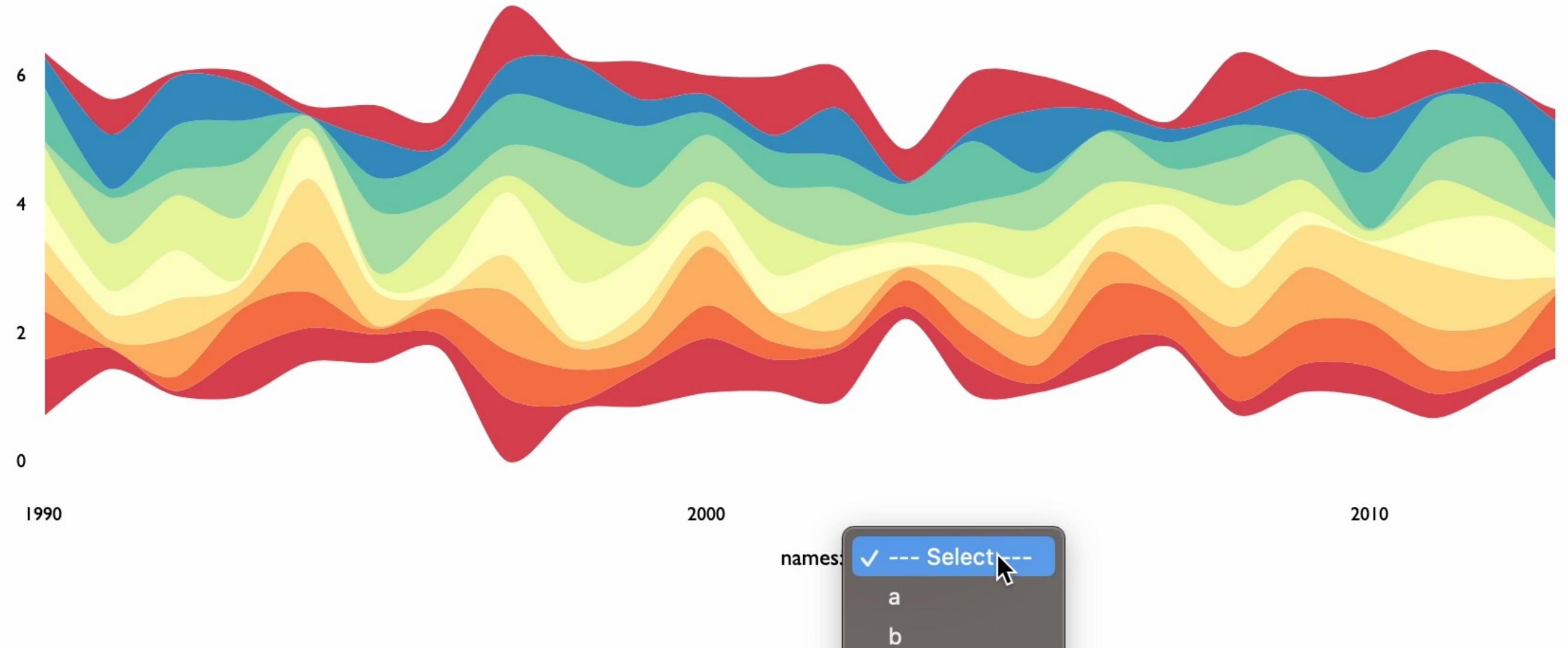


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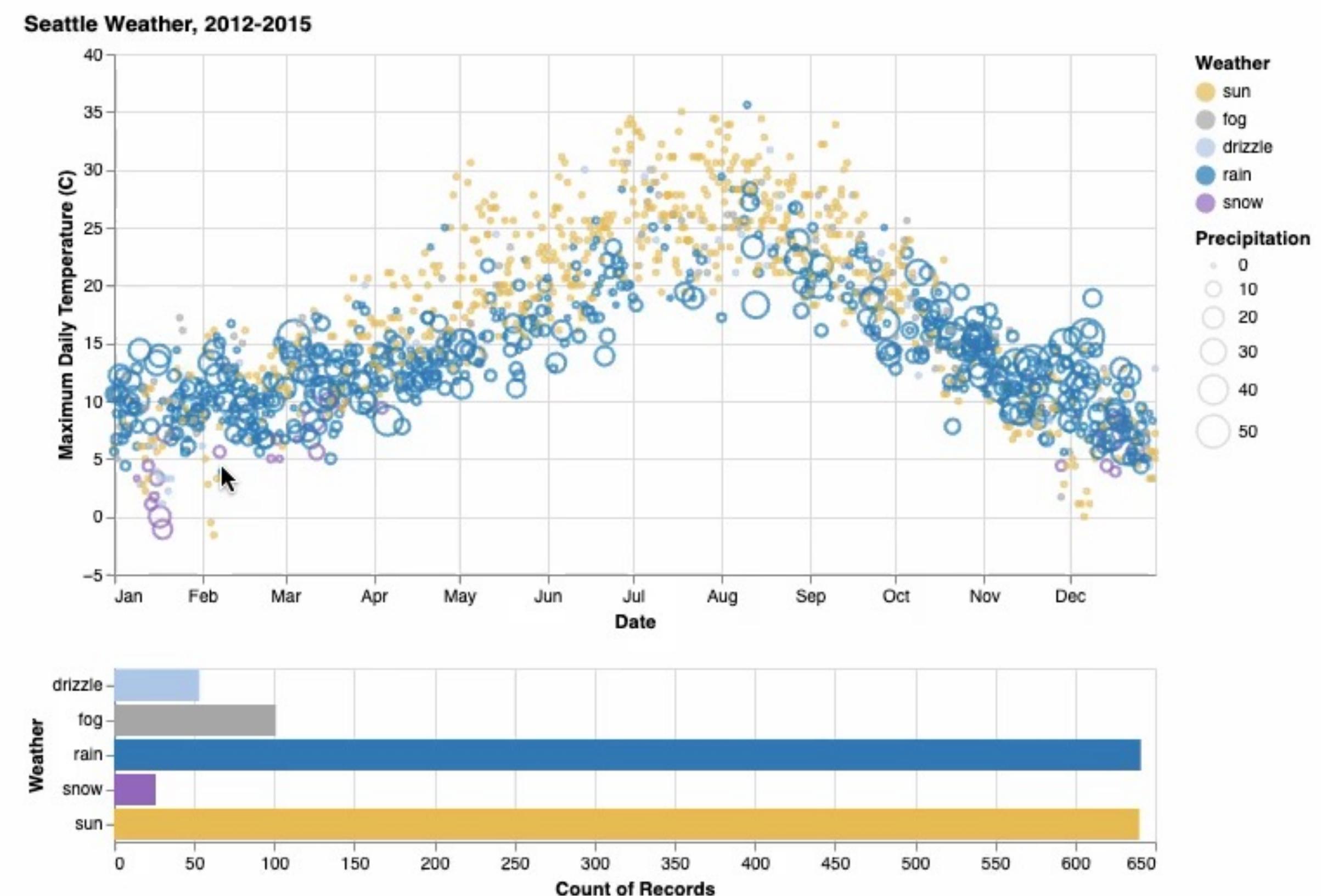
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https://vega.github.io/vega-lite/examples/interactive_seattle_weather.html

FACETING

From Munzner's book

Visualizing Big Data



Faceting

Facet (verb) = to split

Faceting

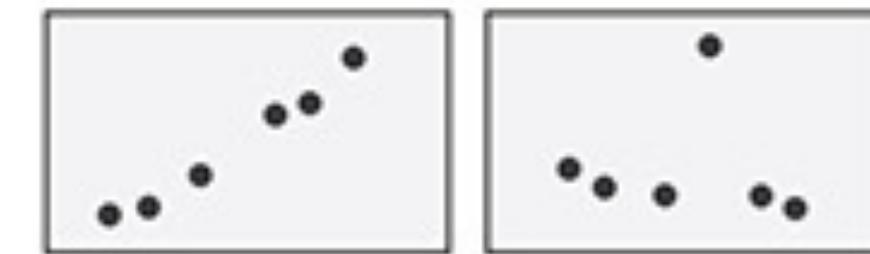
Facet (verb) = to split

In visualization, it means:

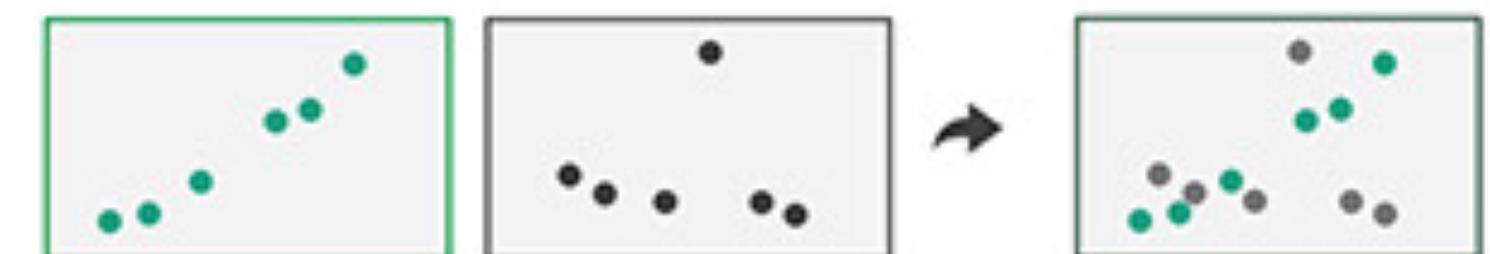
split into multiple views

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

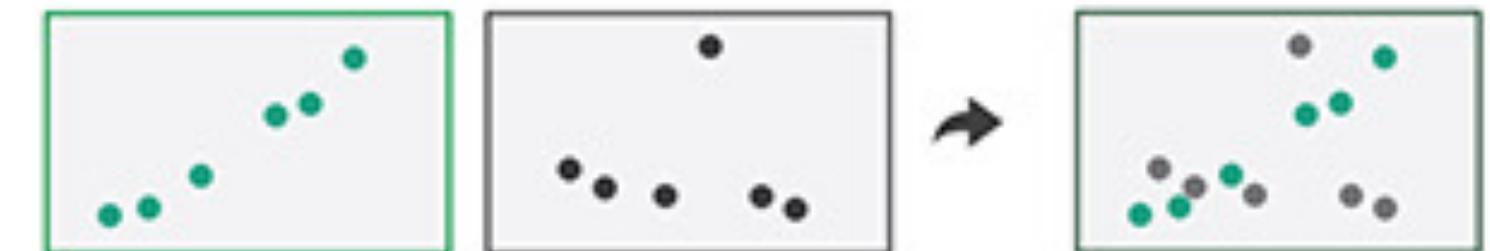
Why?

- complexity reduction
- rely on vision instead of memory retrieval

④ Partition into Side-by-Side Views



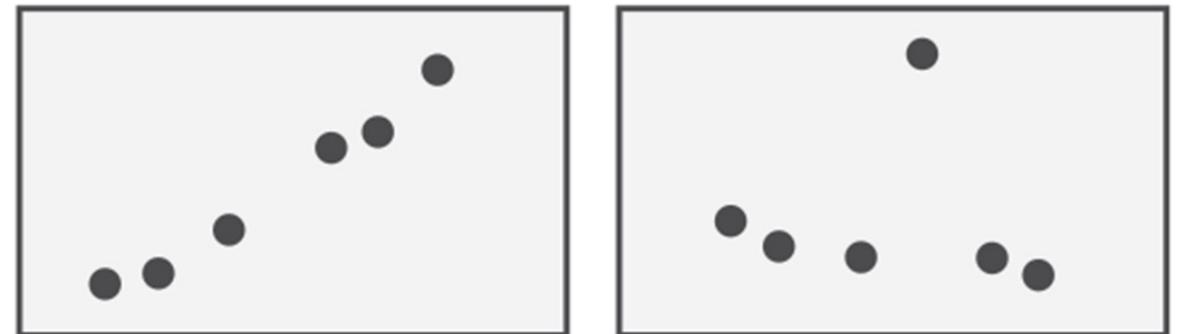
④ Superimpose Layers



Faceting

Side-by-Side Views

- Partition into Side-by-Side Views



Pro:

- Easy to compare

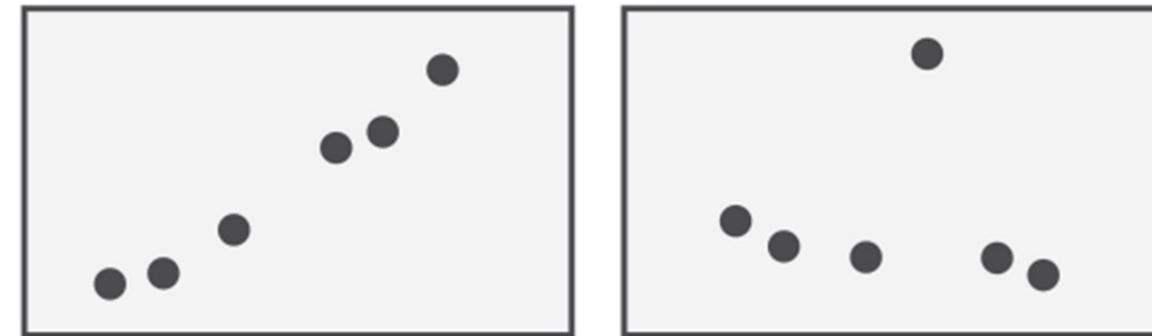
Con:

- Takes up more space on the screen

Faceting

Side-by-Side Views

→ Partition into Side-by-Side Views

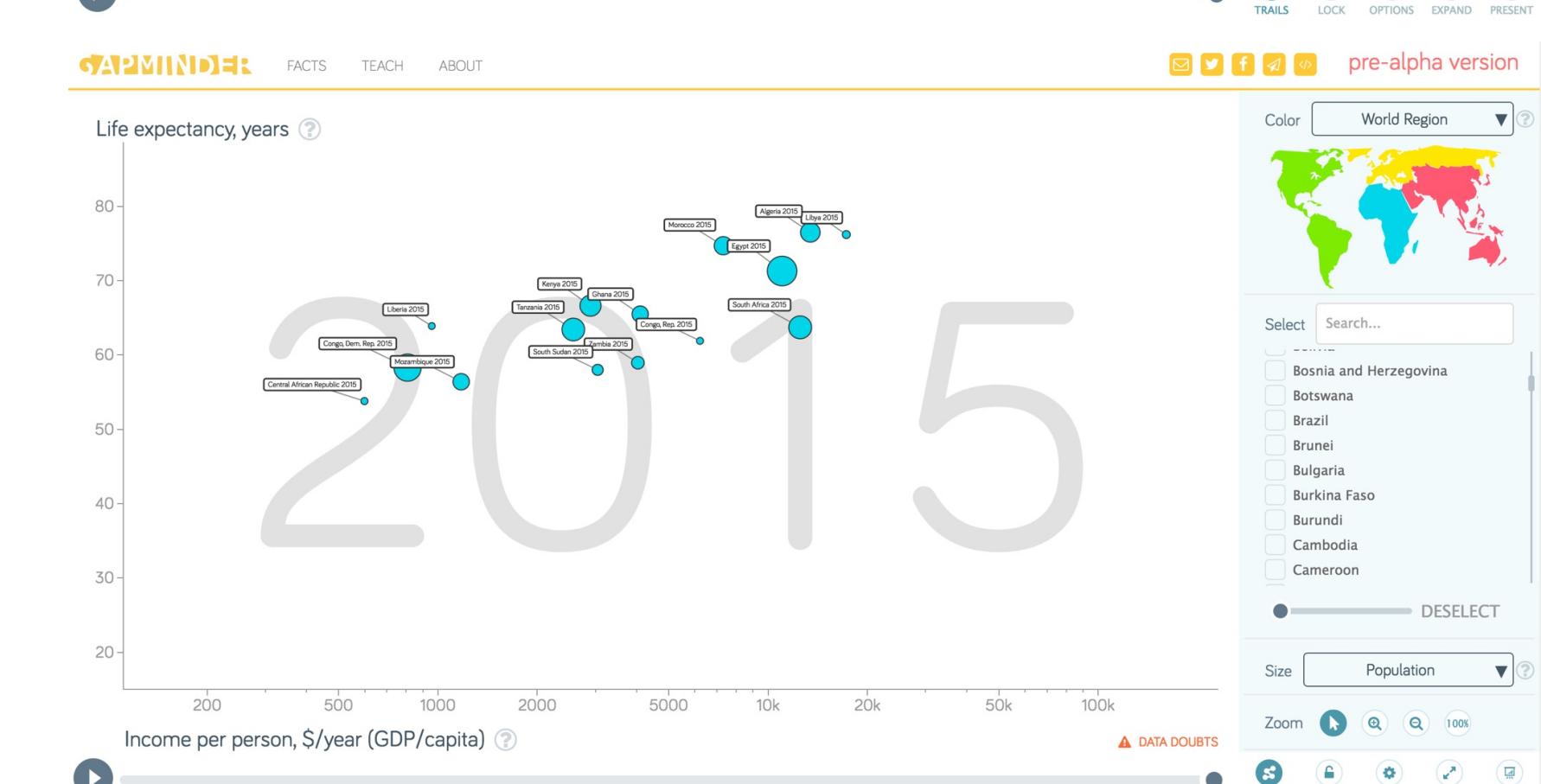
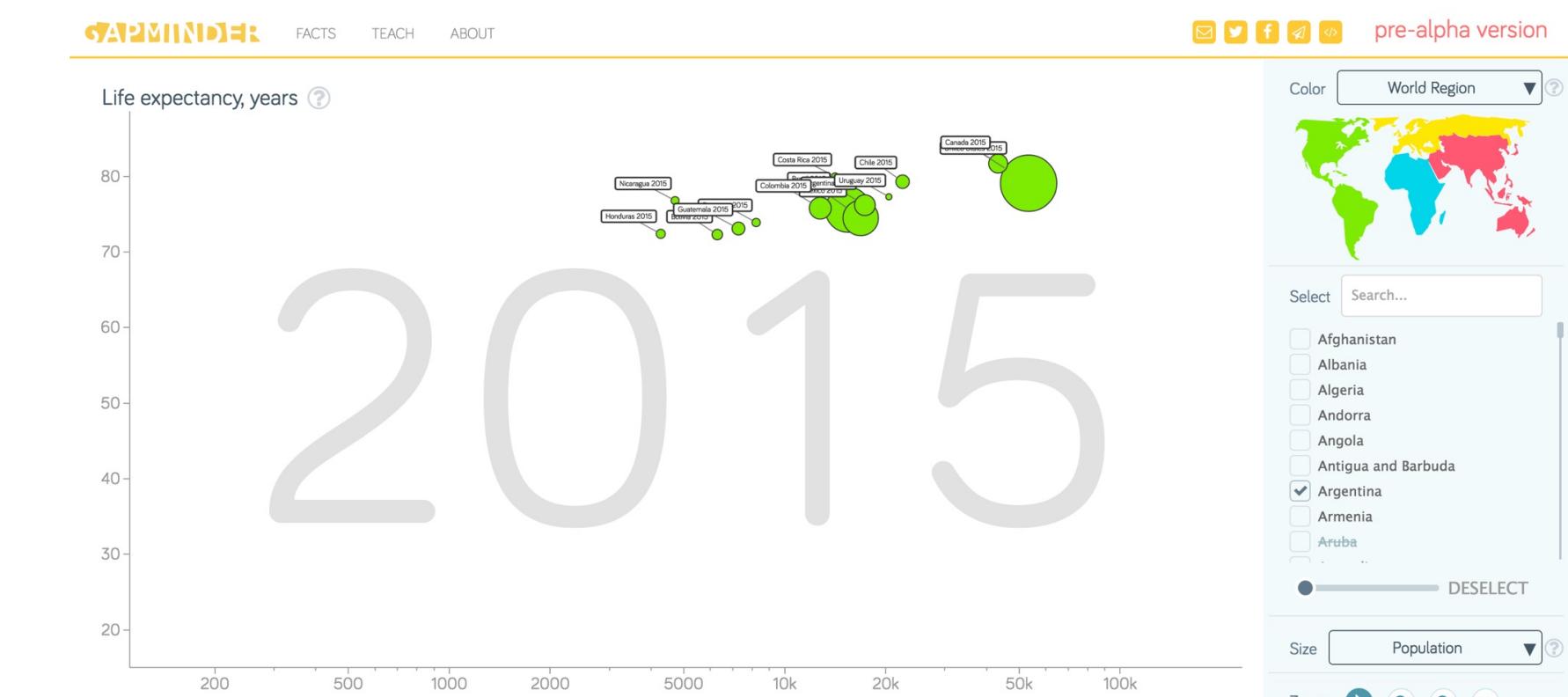


Pro:

→ Easy to compare

Con:

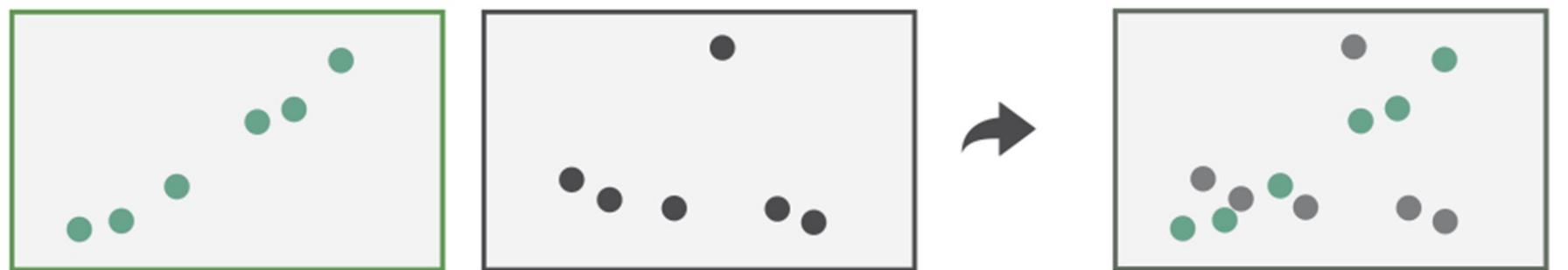
→ Takes up more space on the screen



Faceting

Superimposed Layers

→ Superimpose Layers



Pro:

- Requires less screen space
- Easy to compare

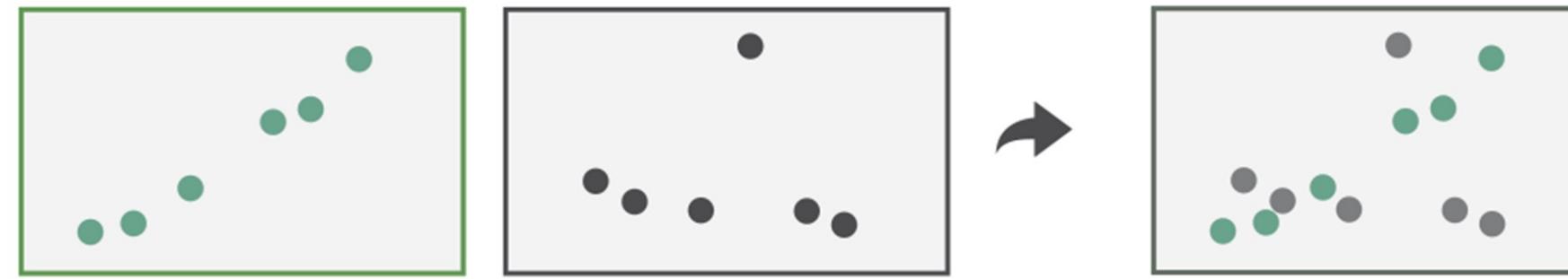
Con:

- Limits encoding options
- Can get messy

Faceting

Superimposed Layers

→ Superimpose Layers

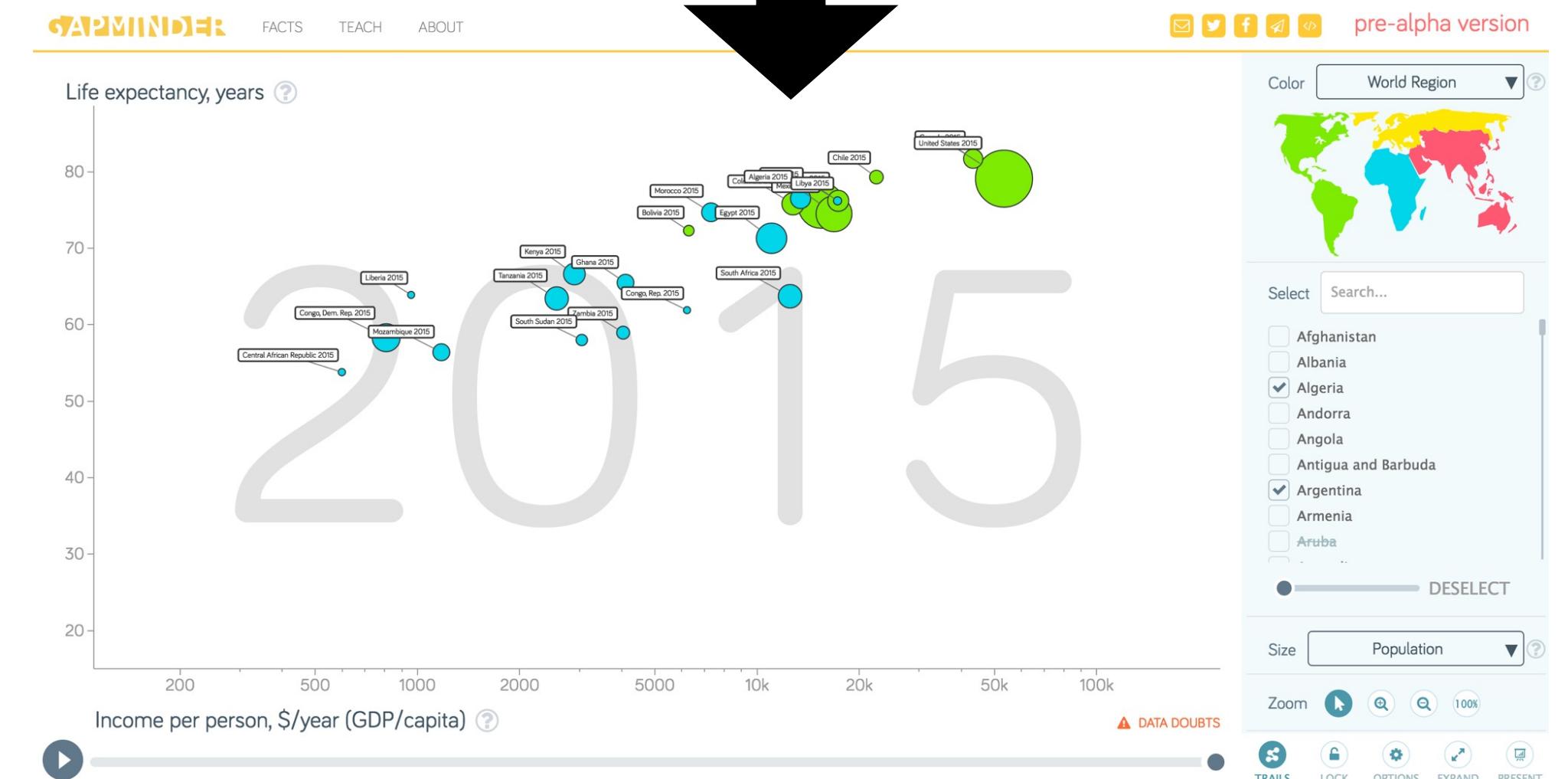
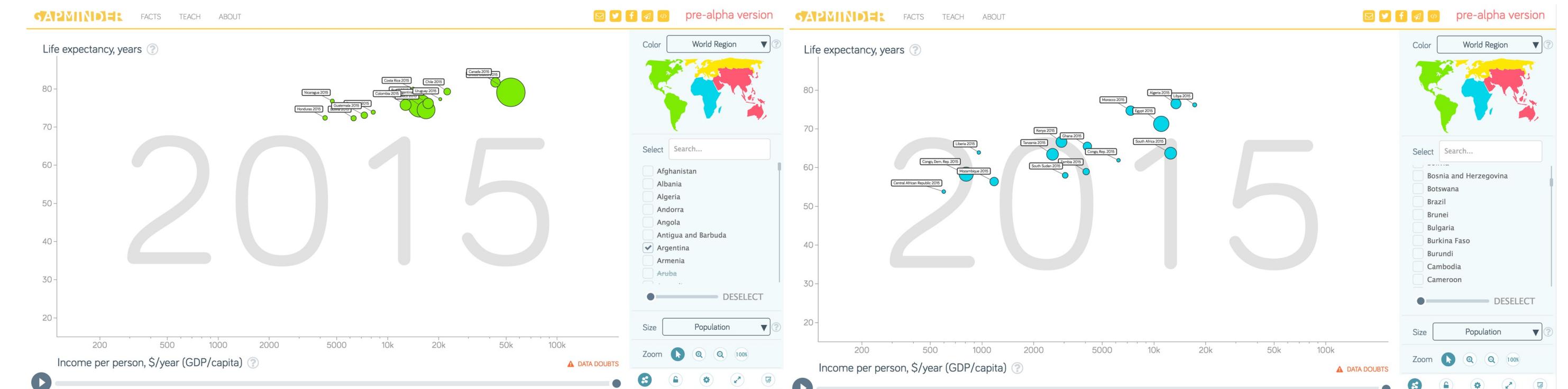


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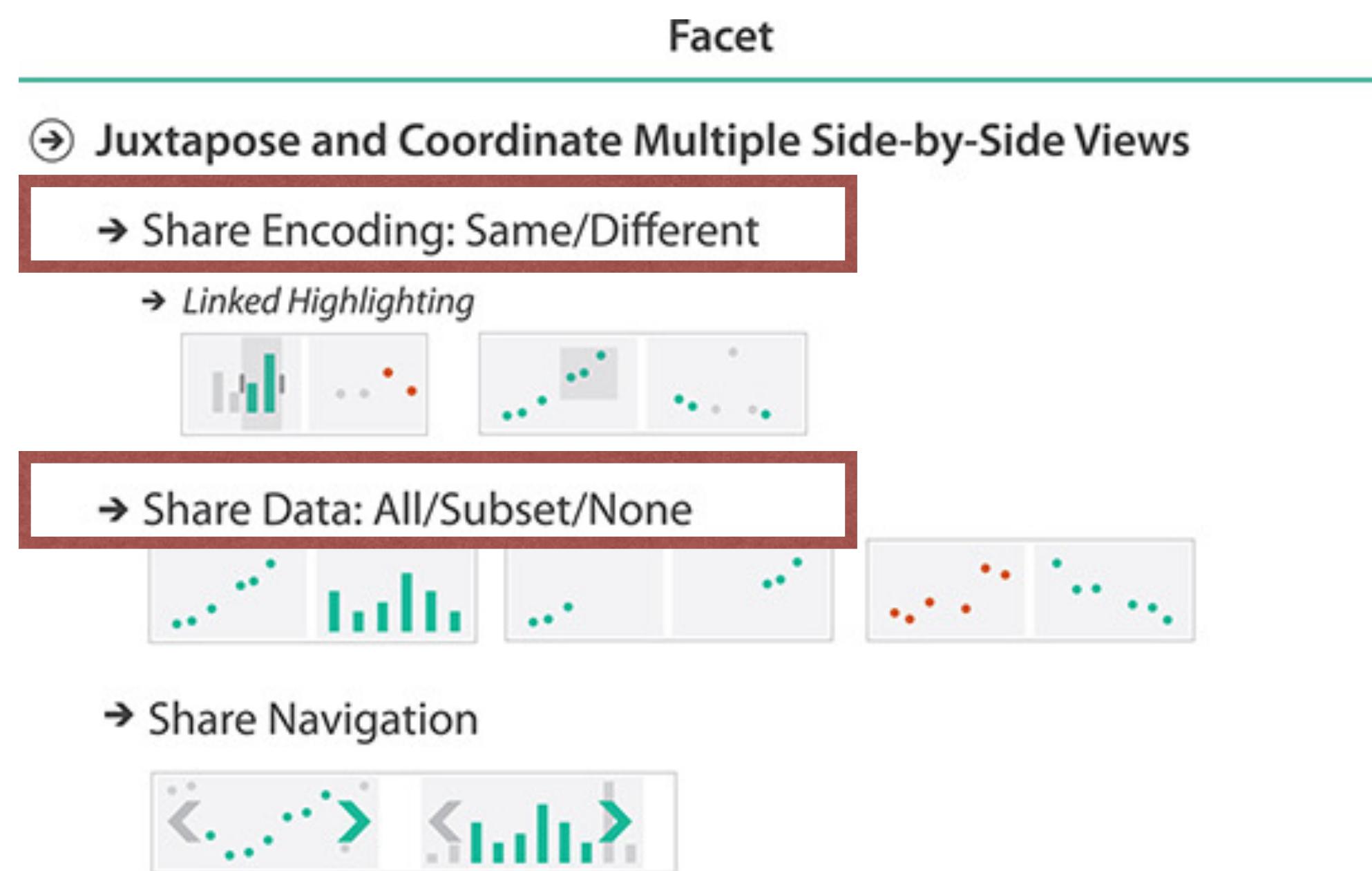


Faceting

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

Faceting

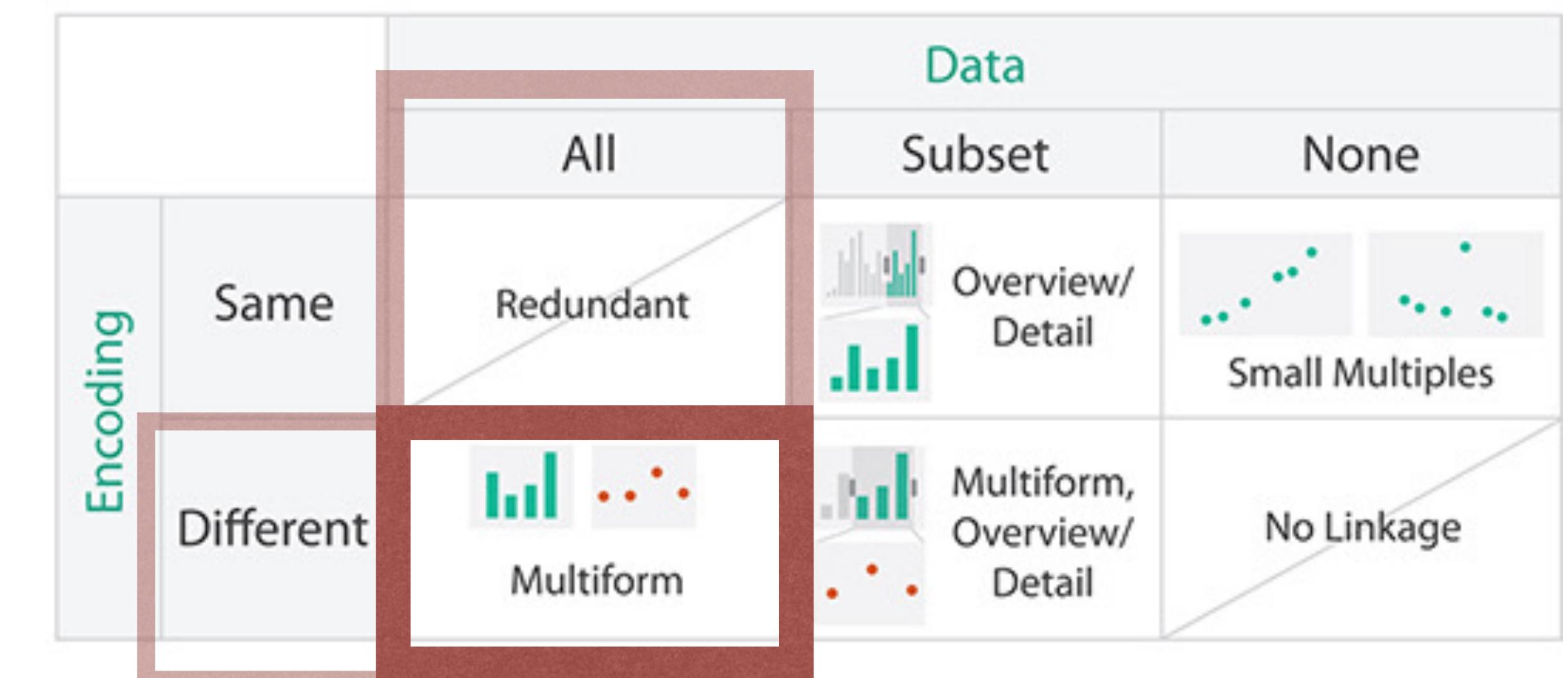
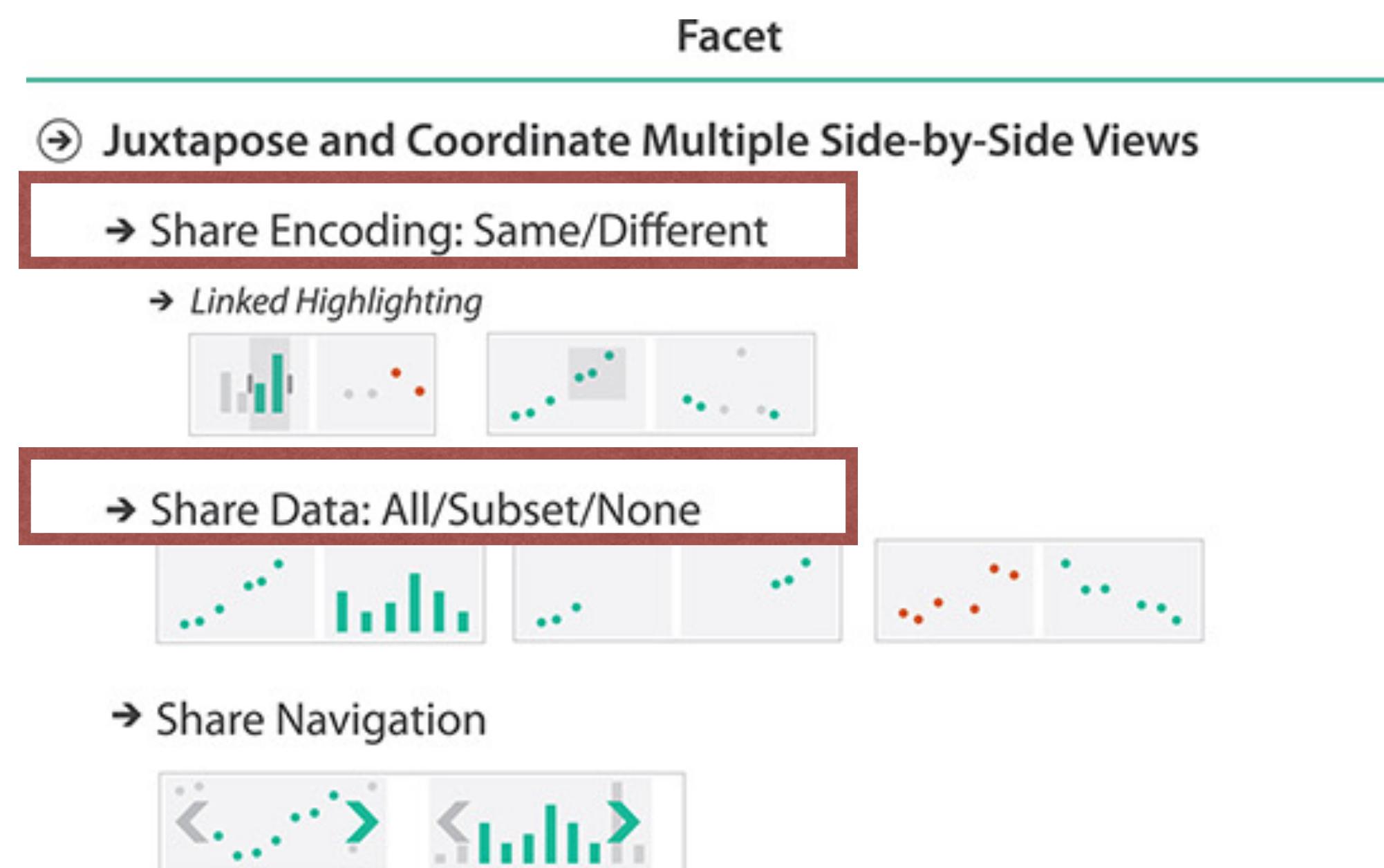
Coordination → In addition to arranging views side-by-side vs. superimposed we need to choose how to coordinate them (or not)



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

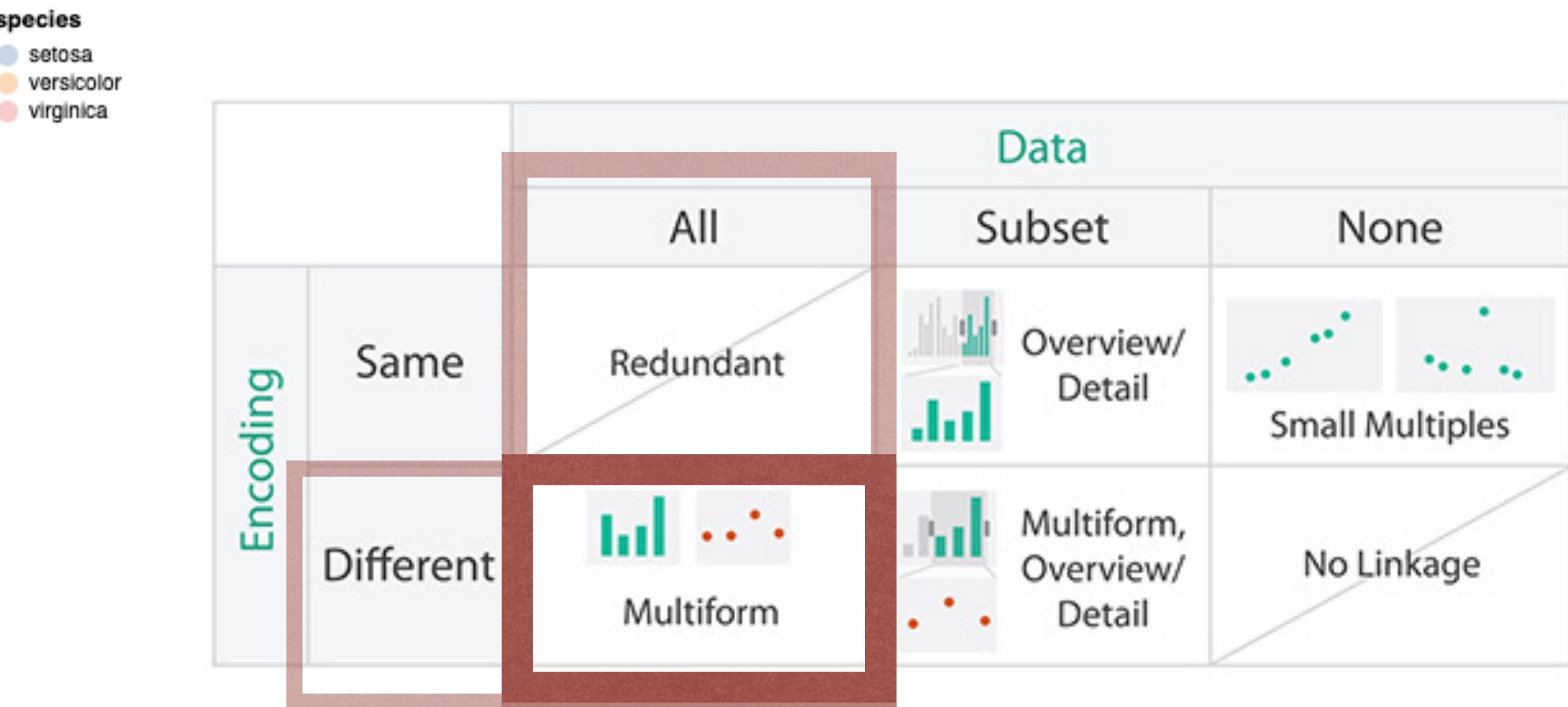
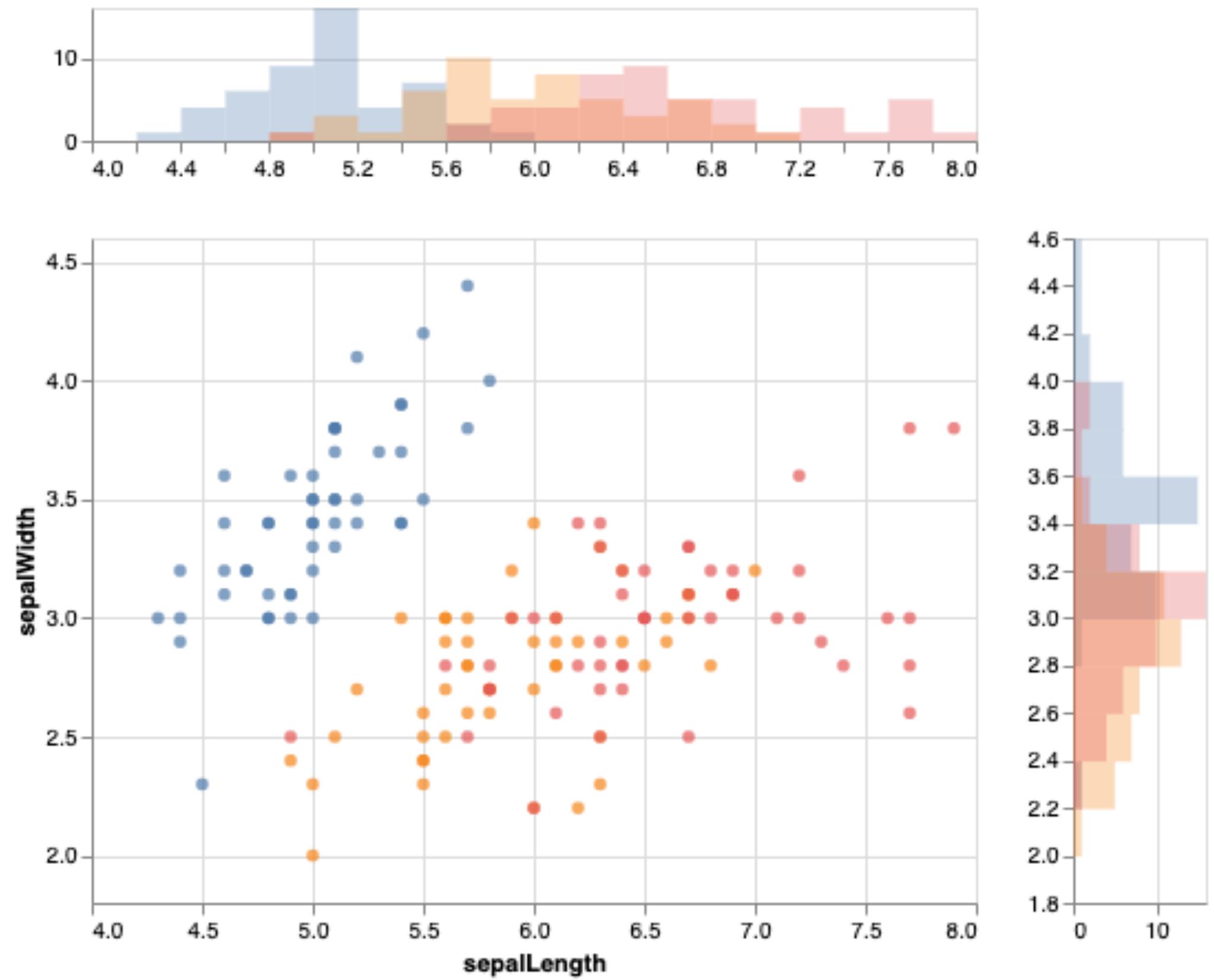
Faceting

Coordination → Multiform



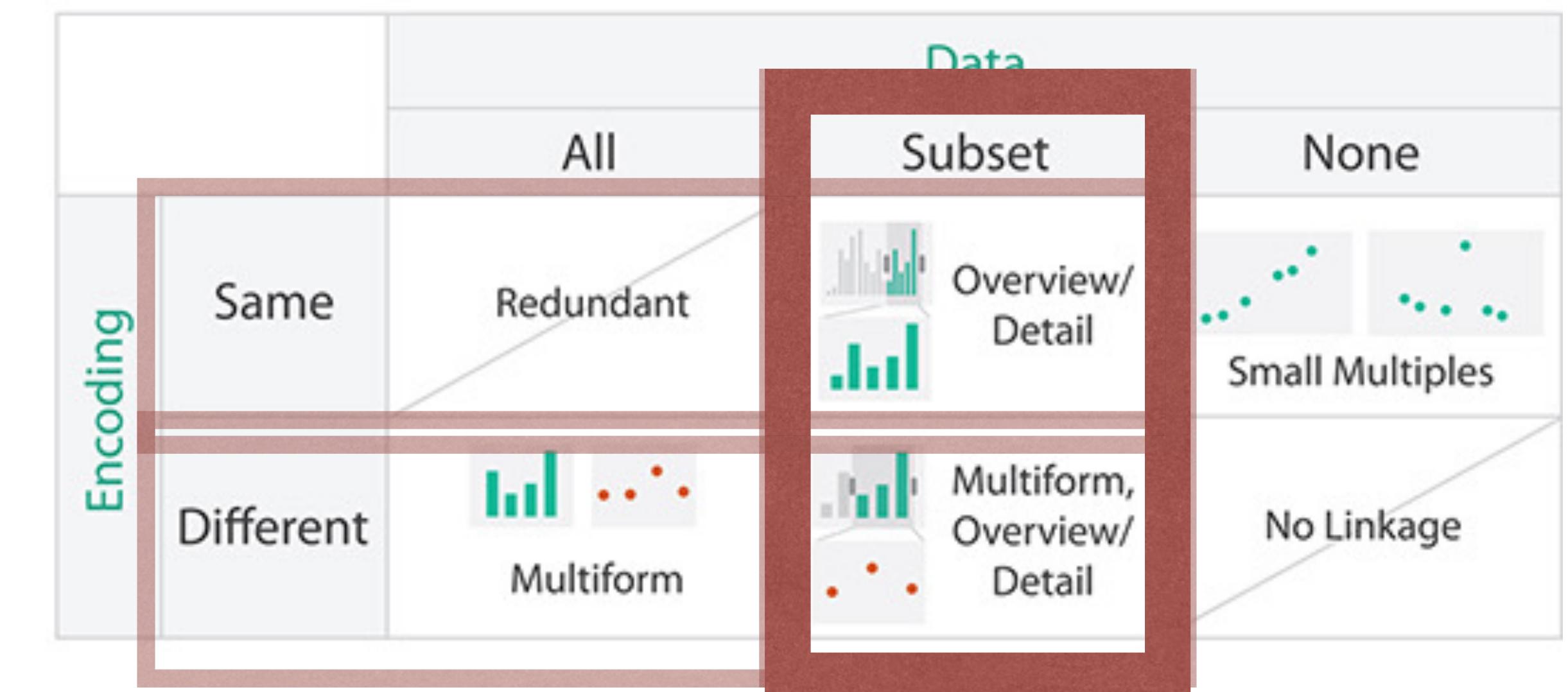
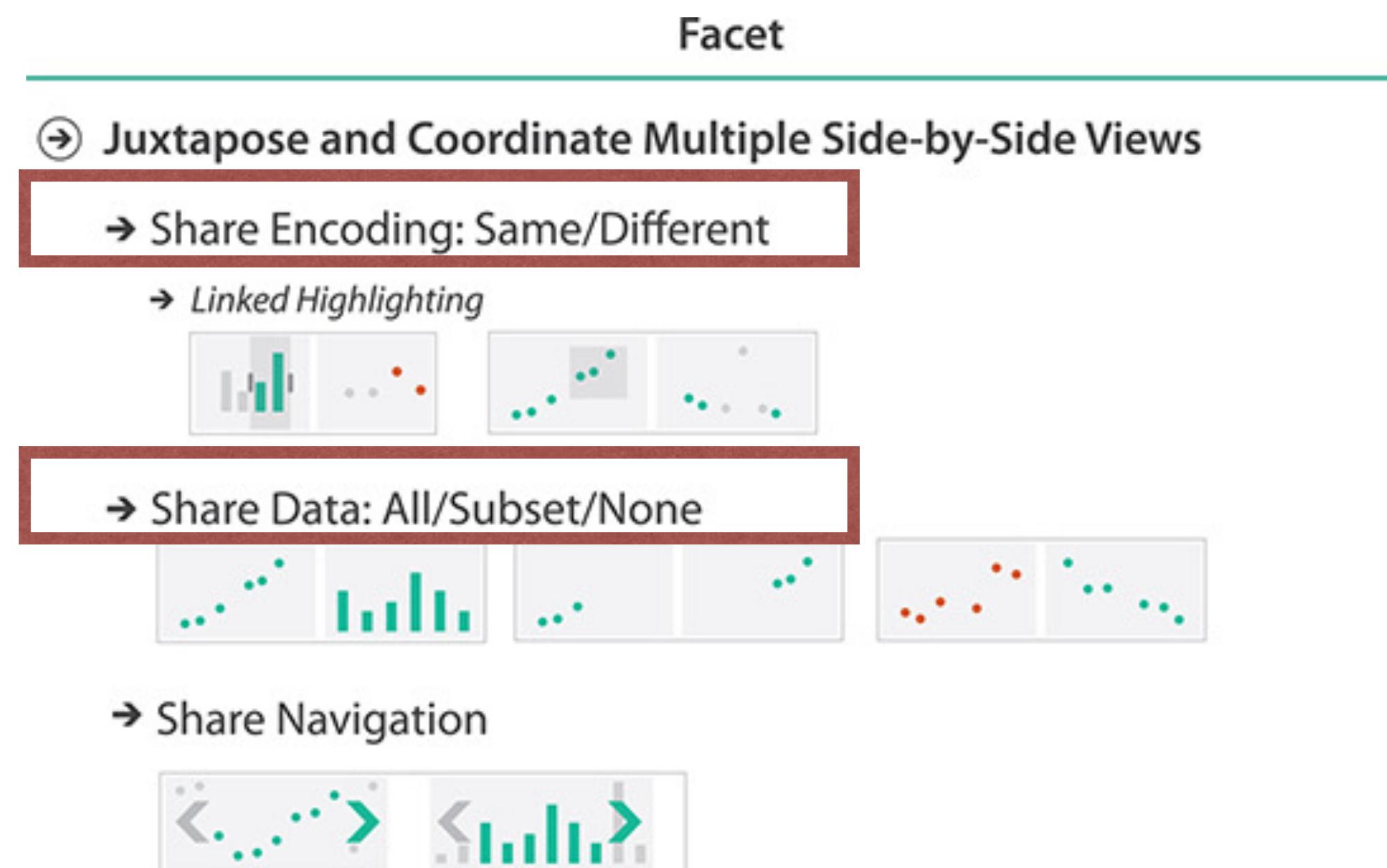
Faceting

Coordination → Multiform



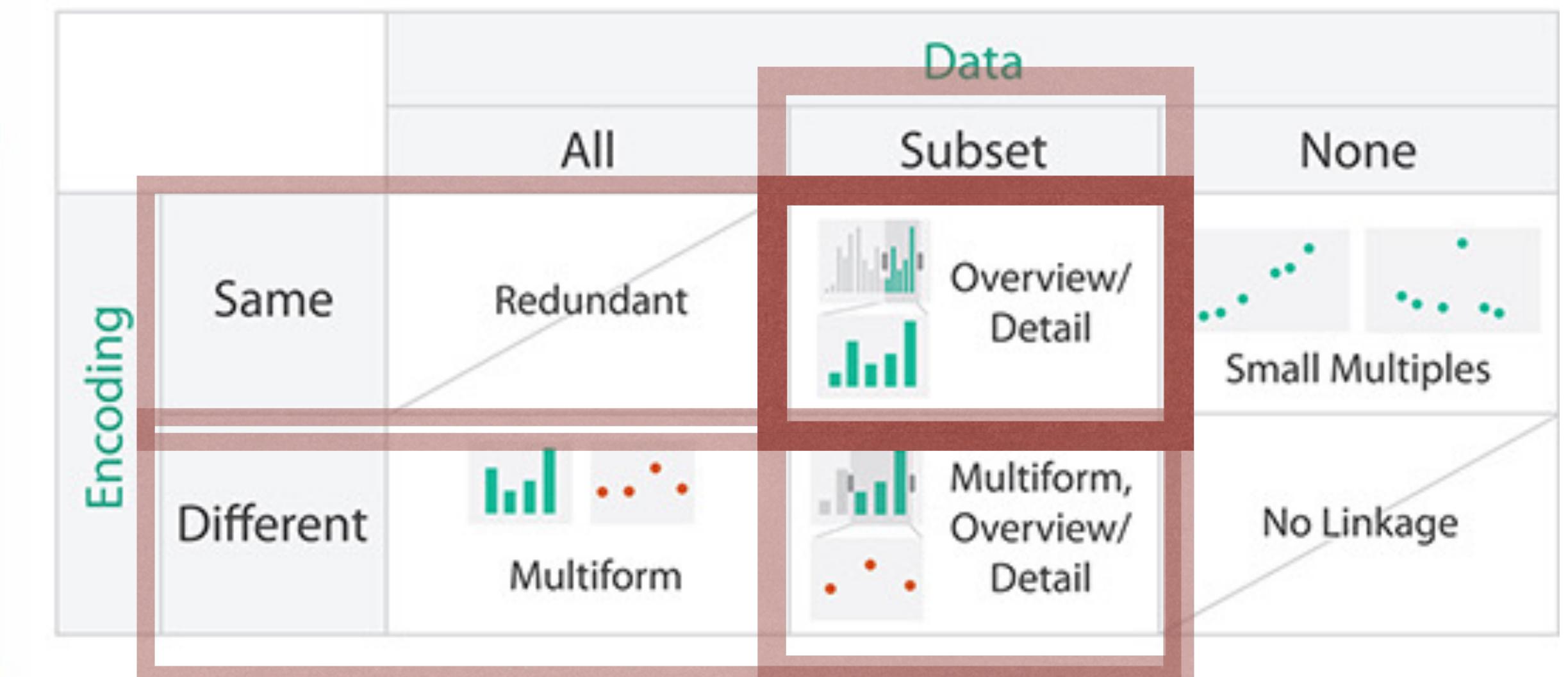
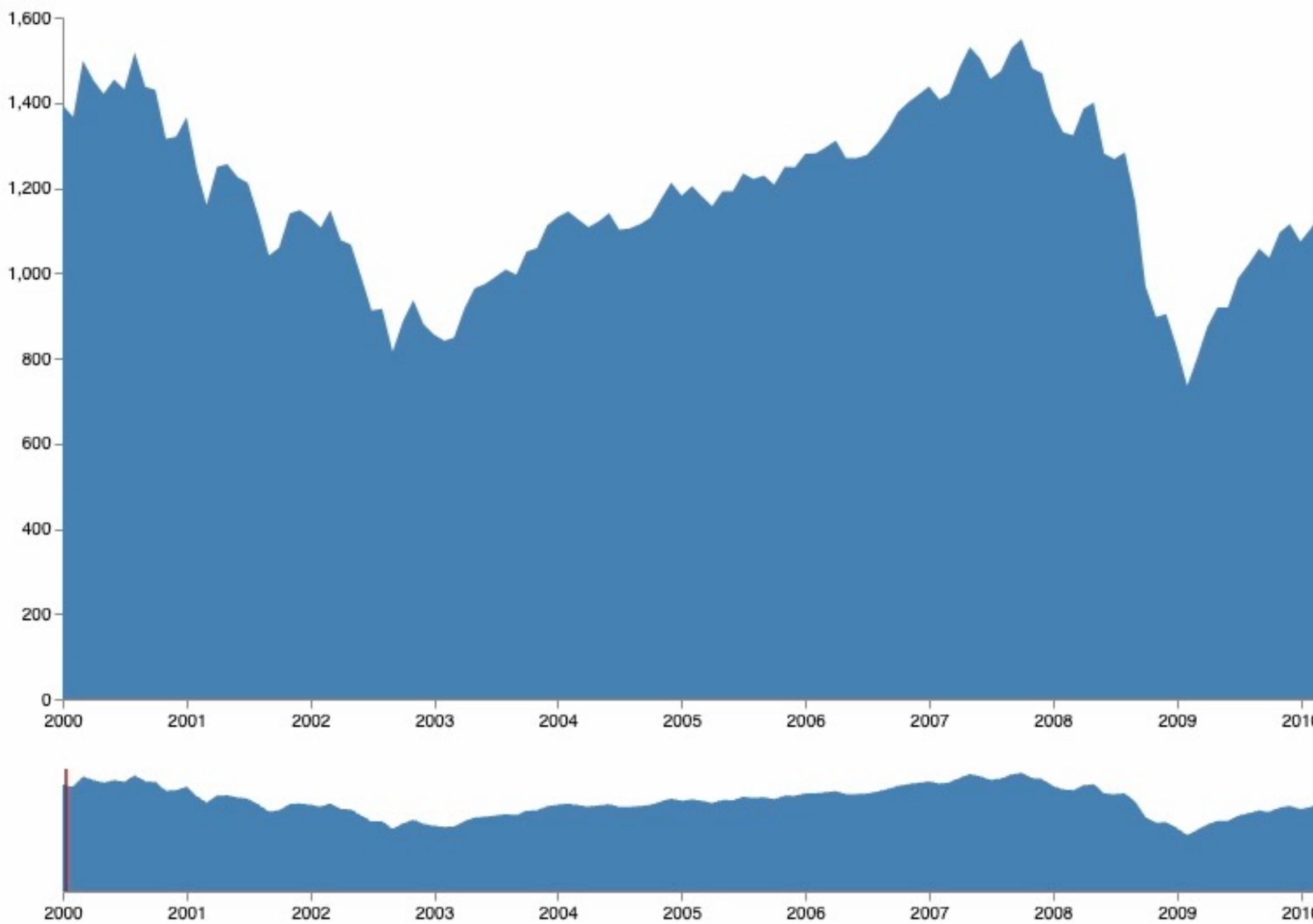
Faceting

Coordinate → Overview/Detail



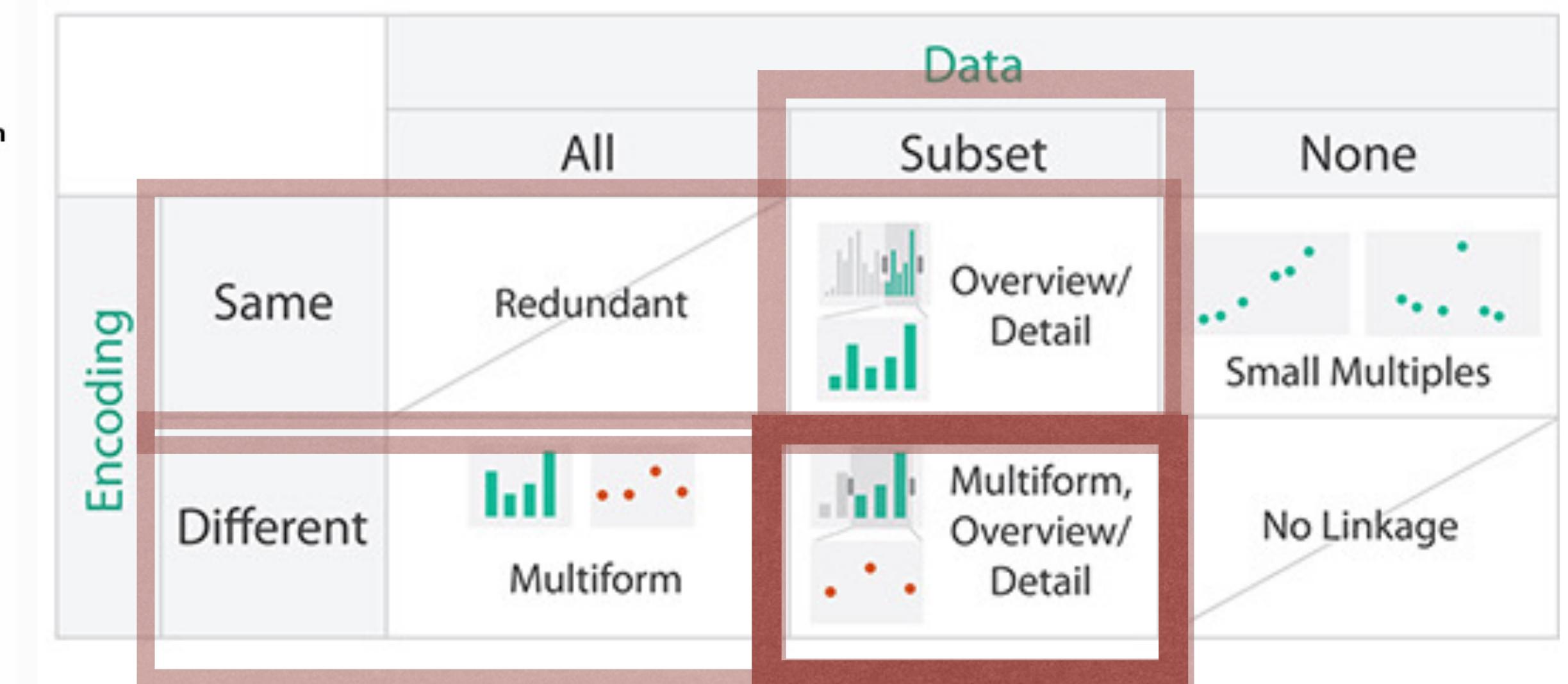
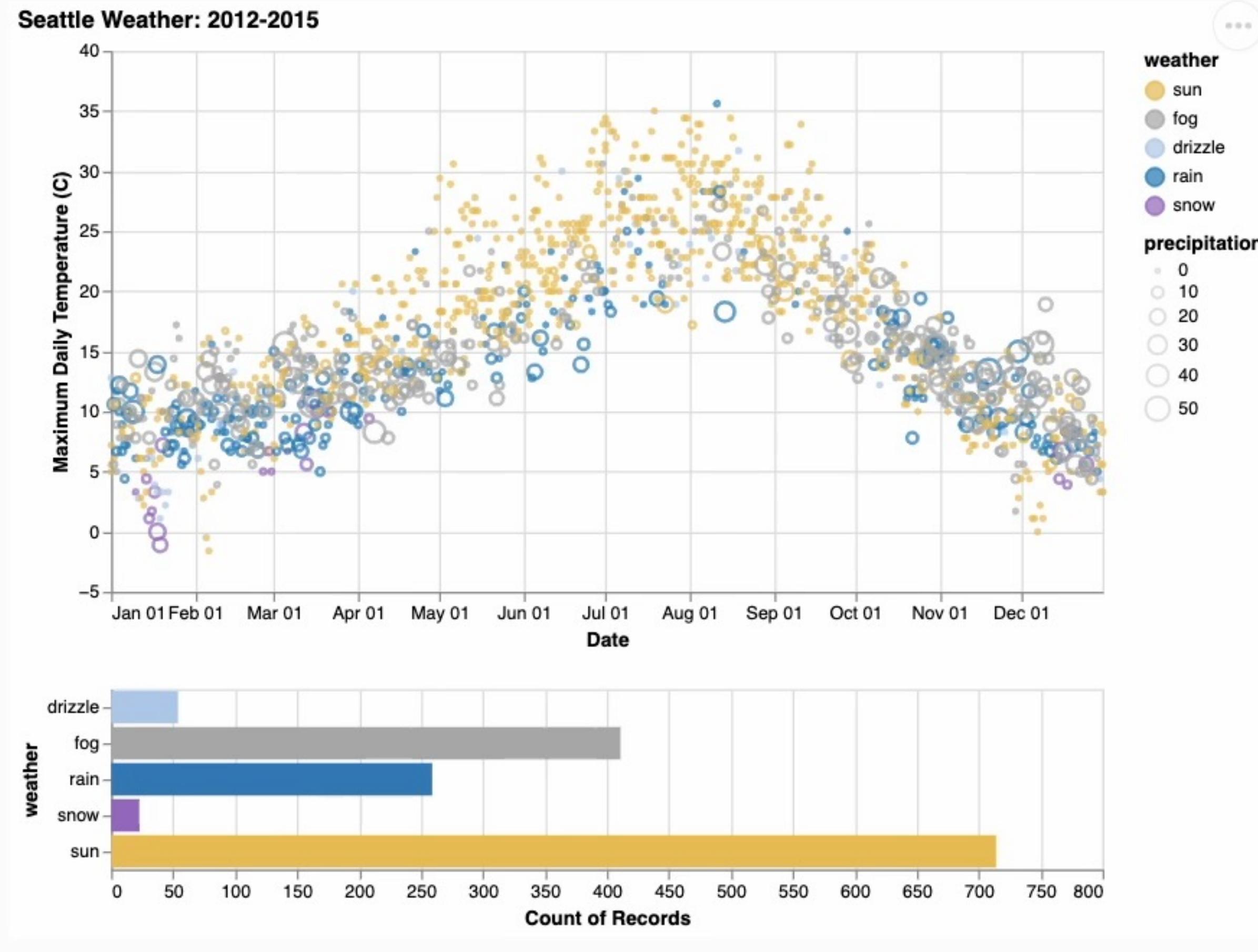
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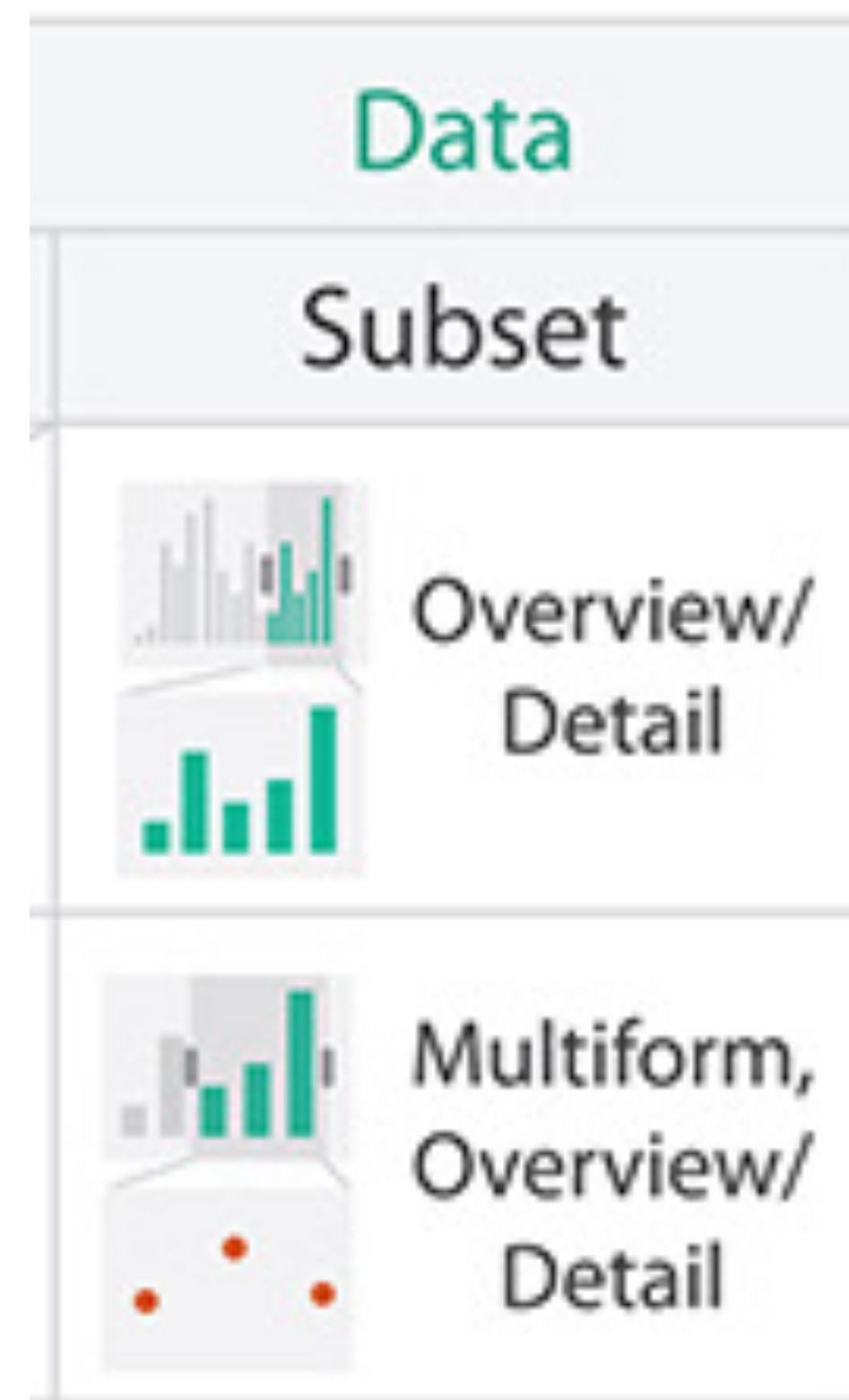


Faceting

Coordinate → Overview/Detail



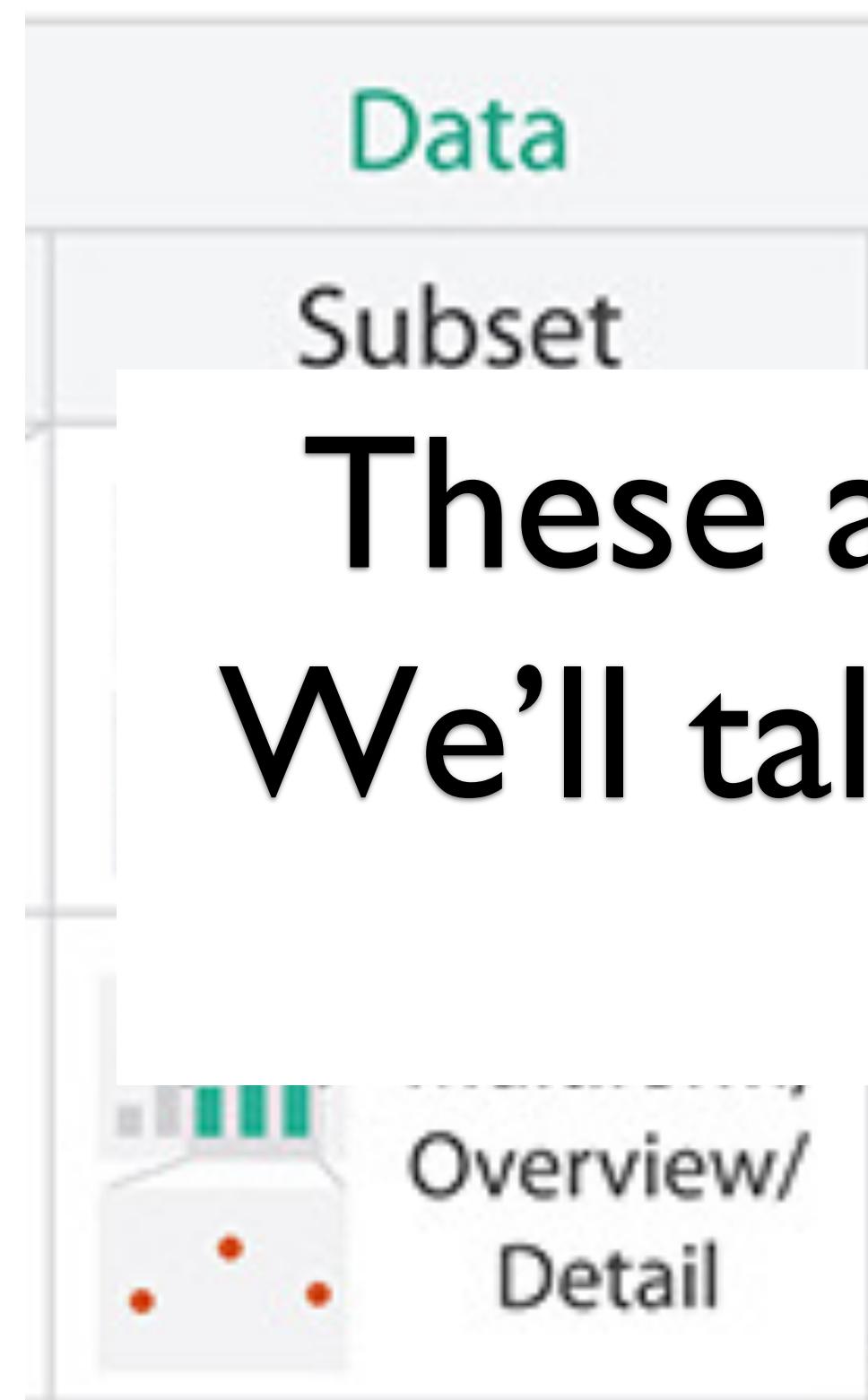
Overview/Detail



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

- Ben Shneiderman

Overview/Detail



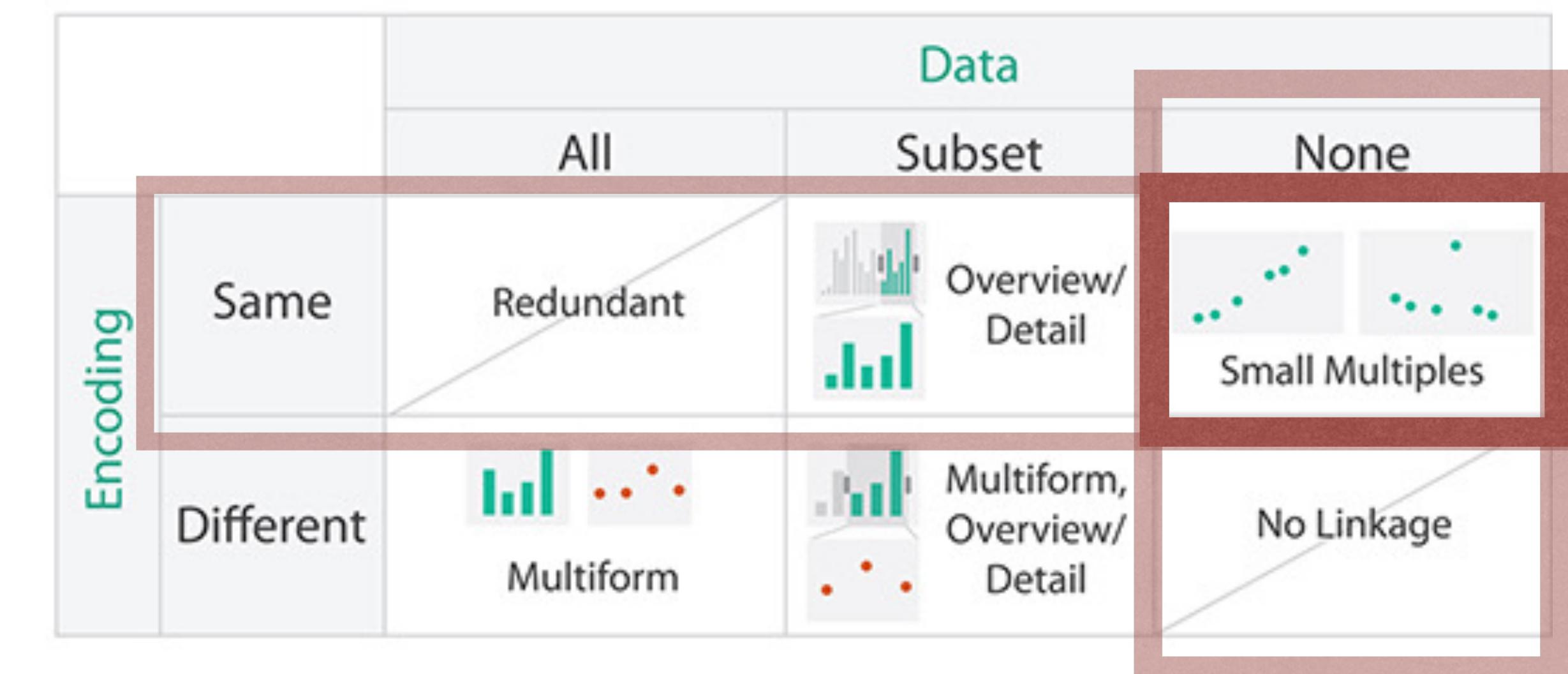
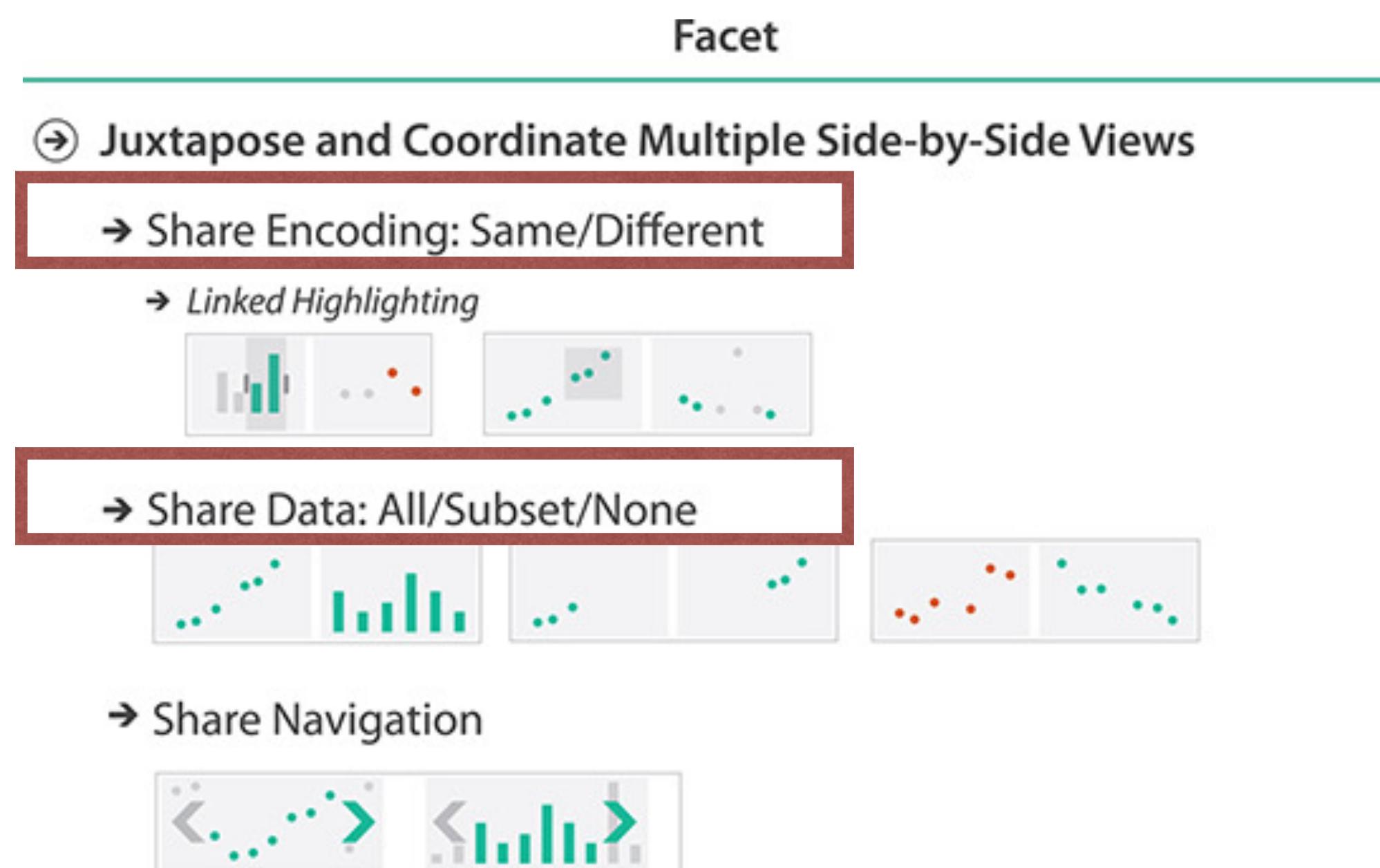
**These are Focus + Context Designs.
We'll talk more about this approach in
future lectures.**

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

- Ben Shneiderman

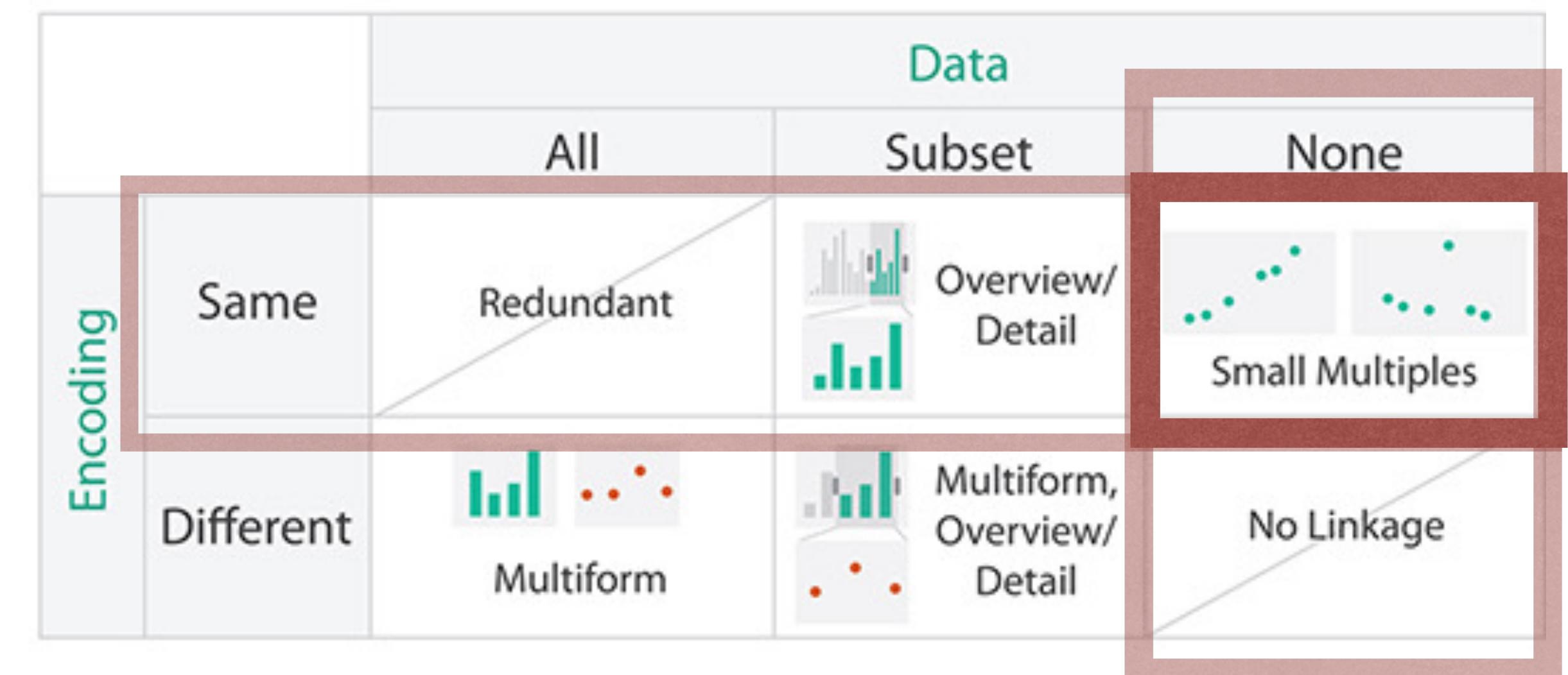
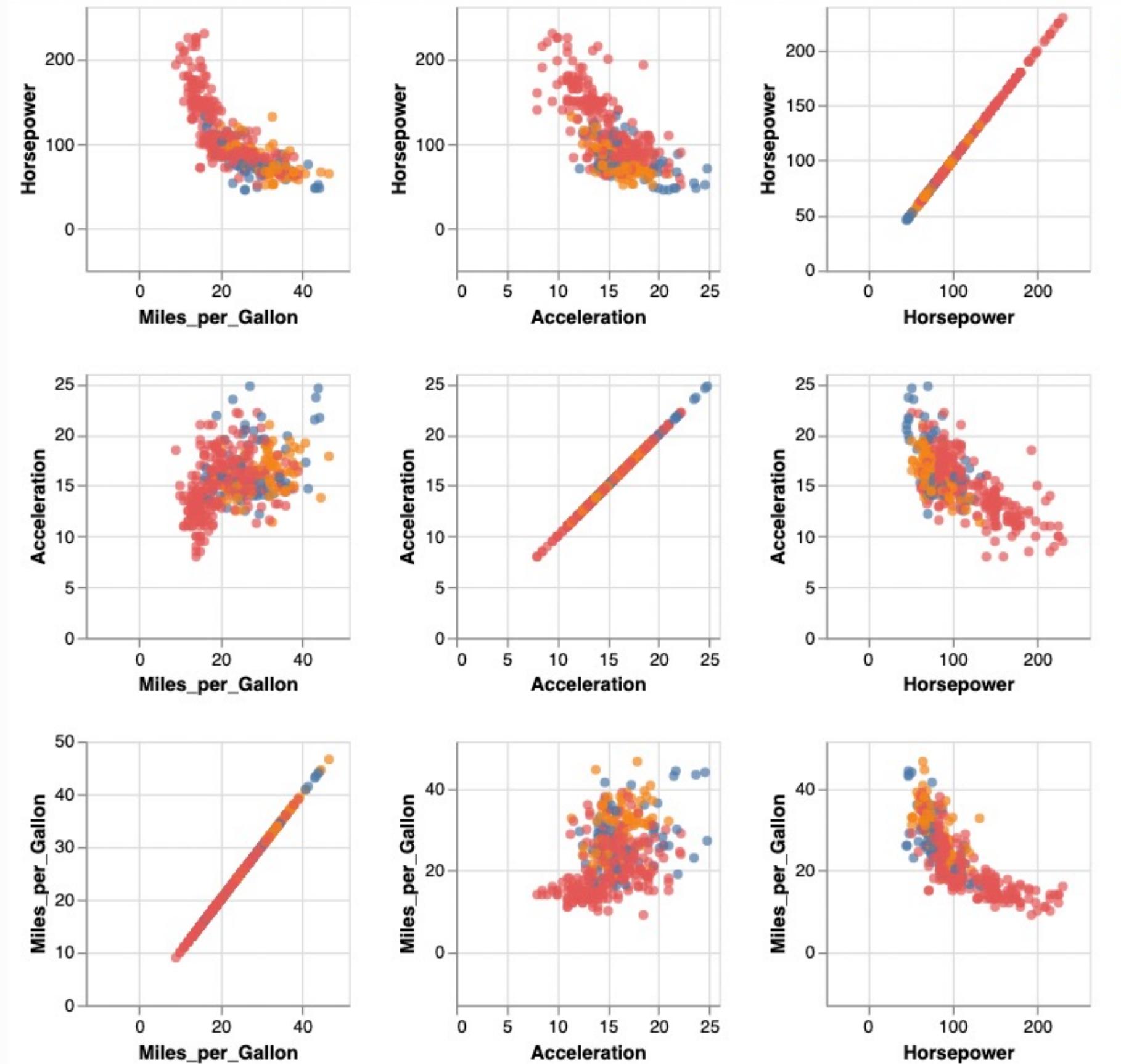
Faceting

Coordinate → Small Multiples



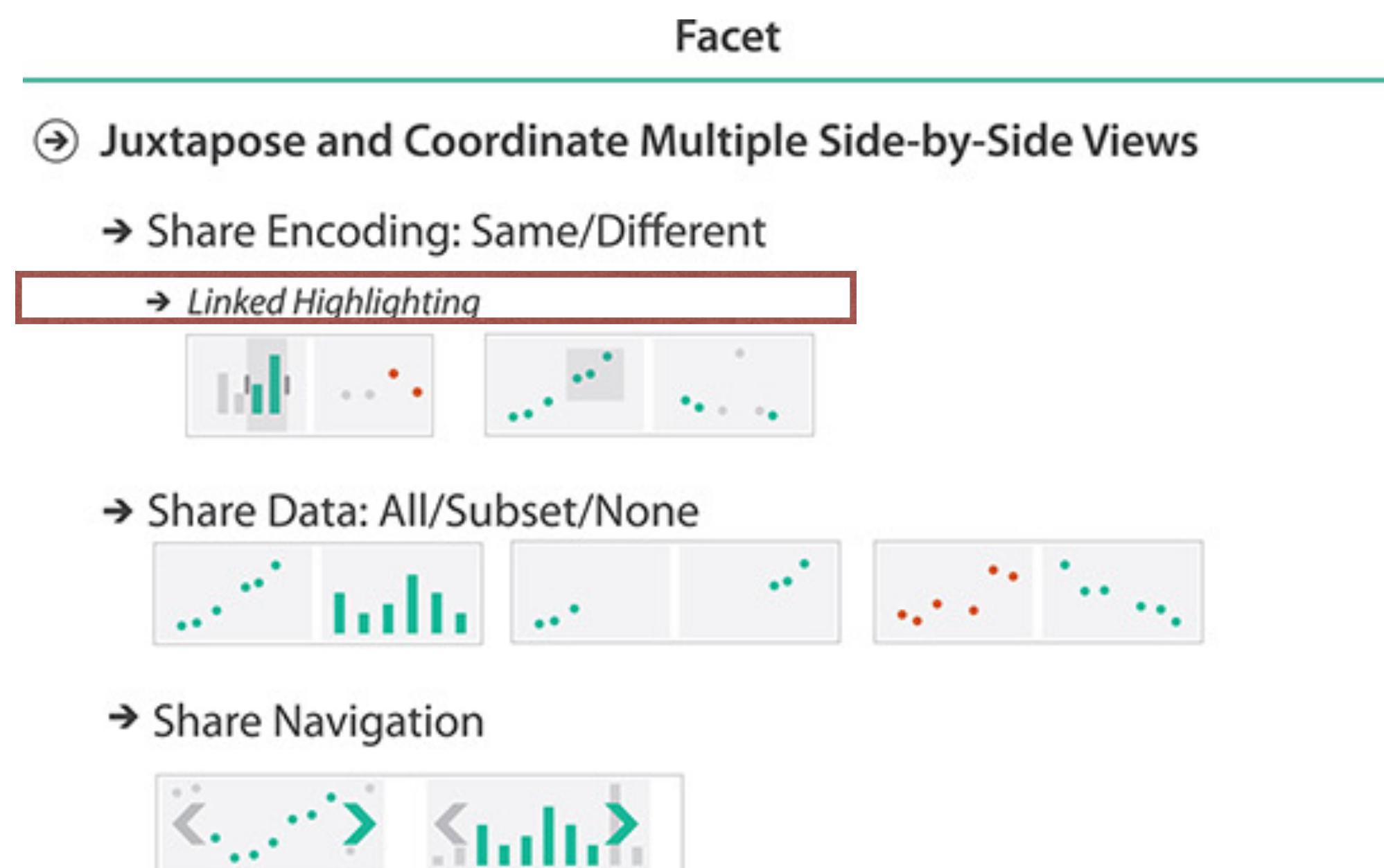
Faceting

Coordinate → Small Multiples



Faceting

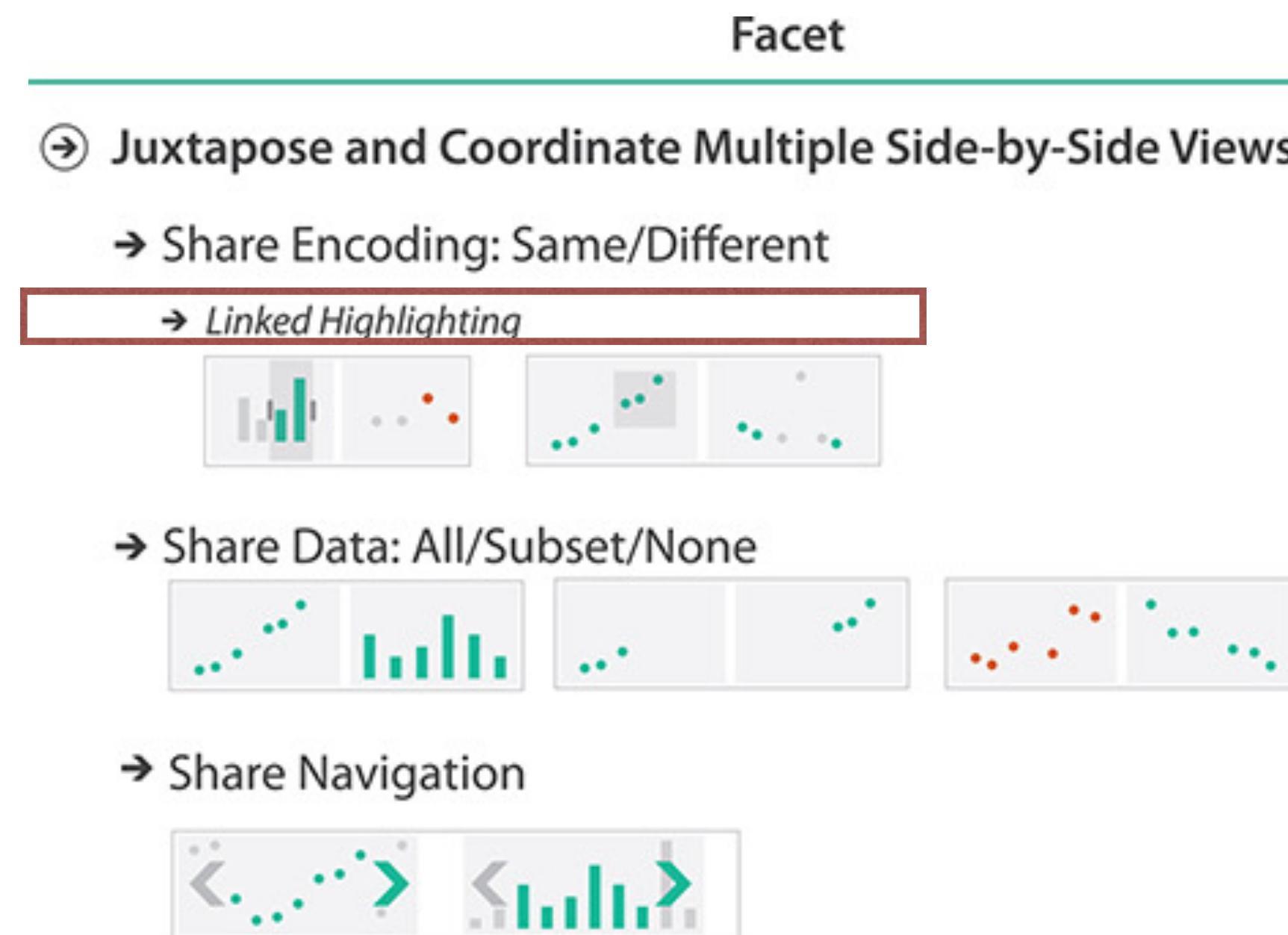
Coordinate → Linked Highlighting



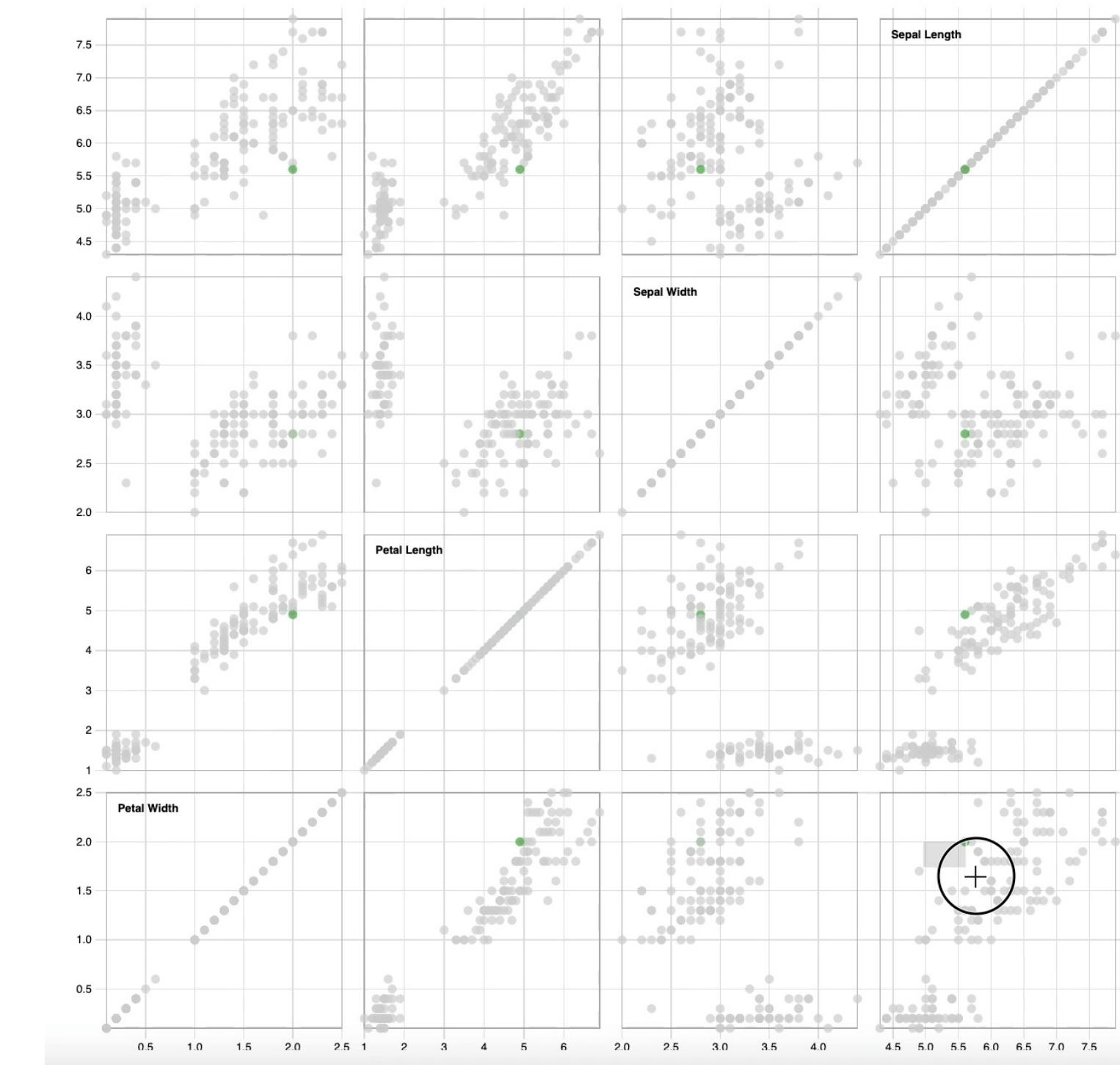
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Brushing and Linking

Coordinate → Brushing and Linking



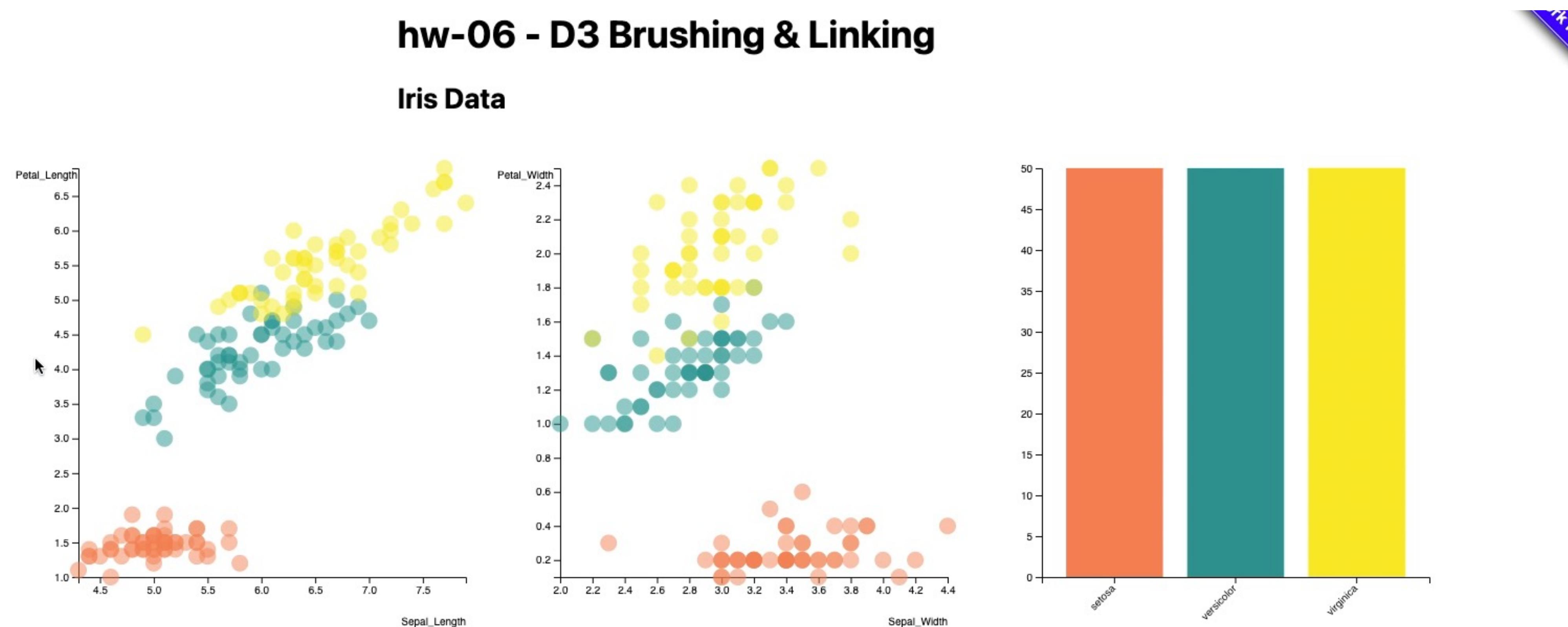
Scatterplot Matrix Brushing



<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

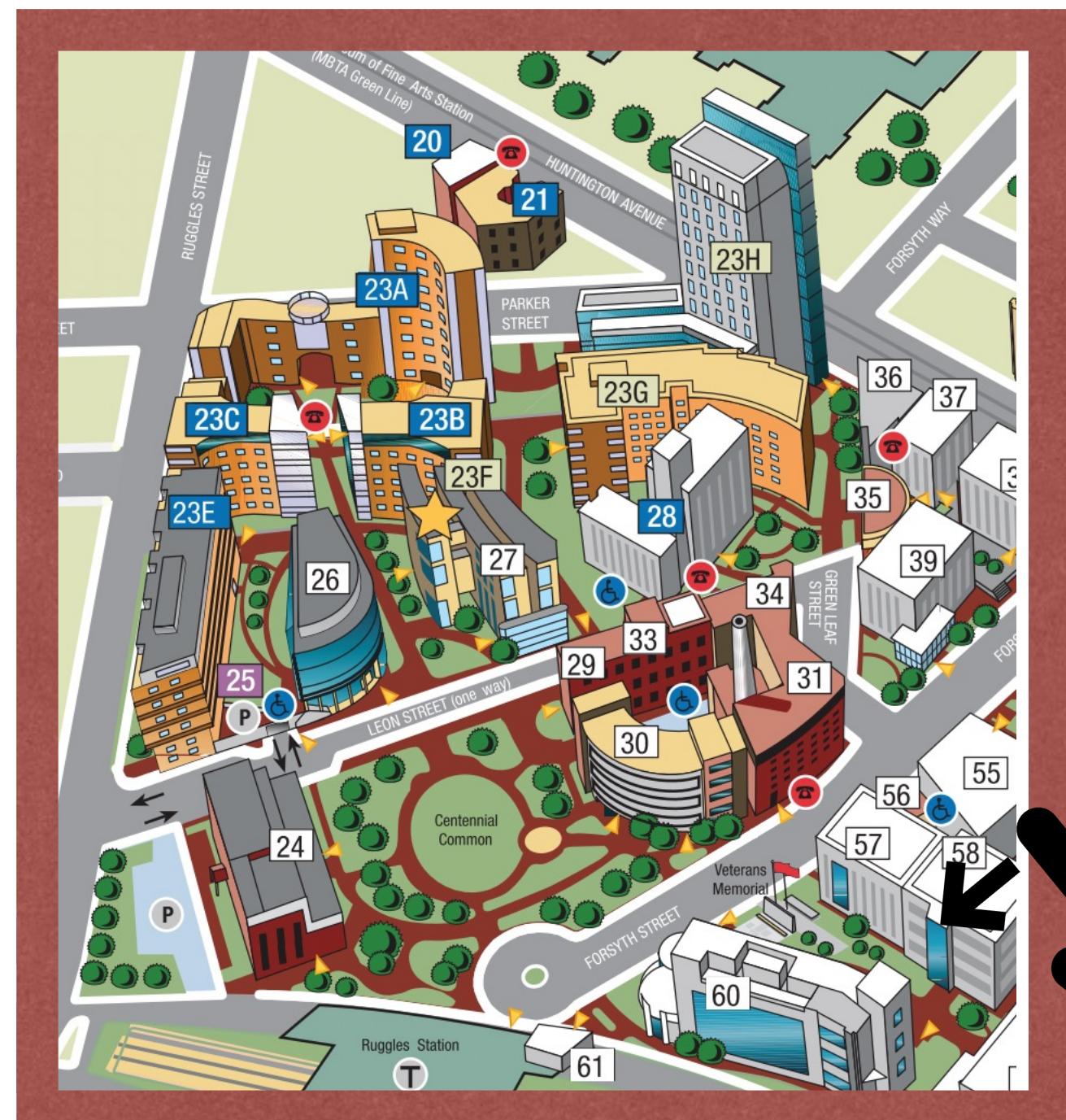
→ *Linked Highlighting*



→ Share Data: All/Subset/None



→ Share Navigation



Navigation

Coordinate

Facet

④ Juxtapose and Coordinate Multiple Side-by-Side Views

→ Share Encoding: Same/Different

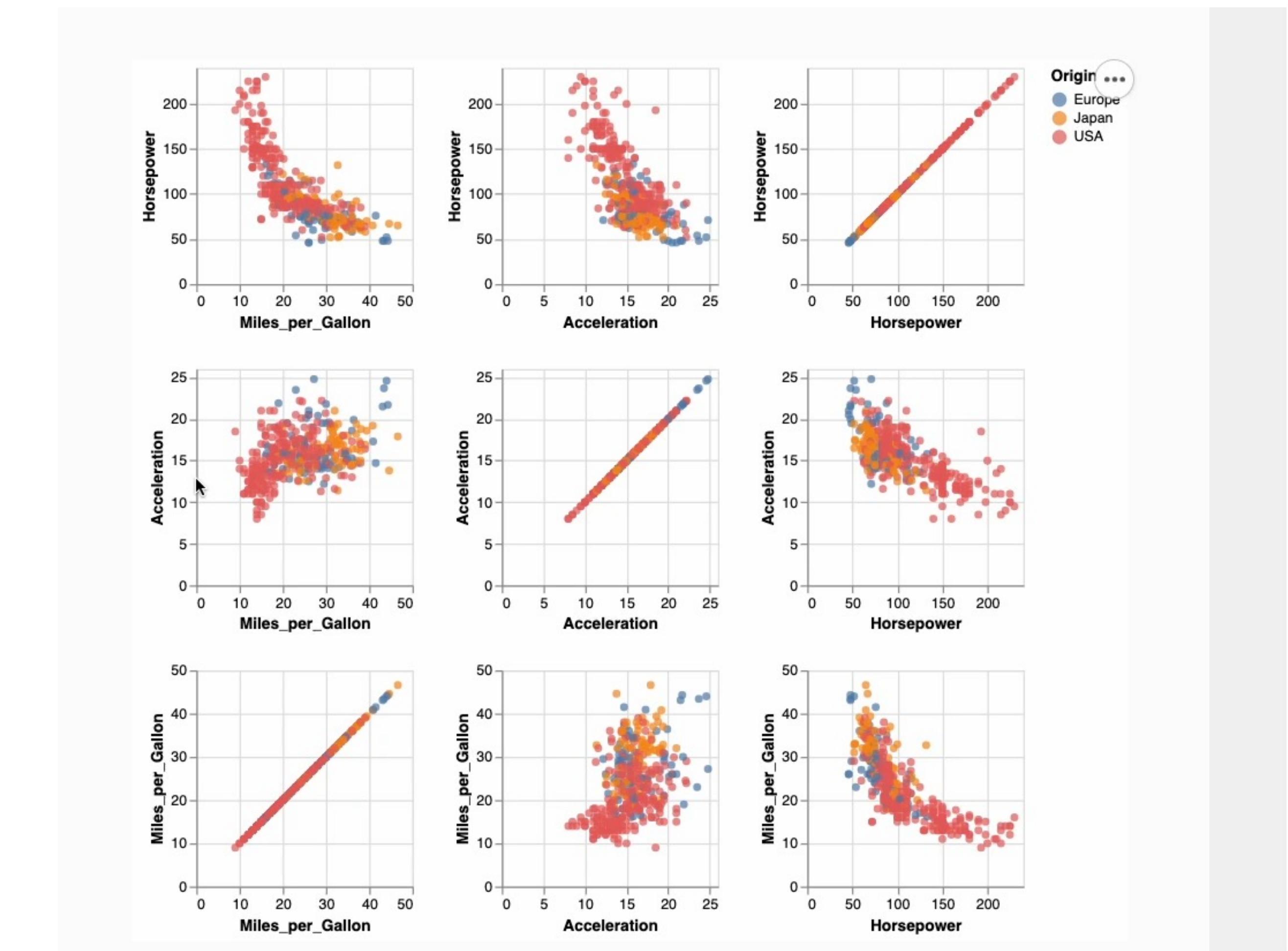
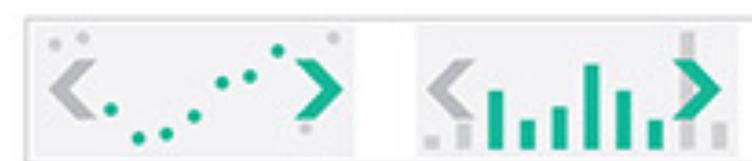
→ *Linked Highlighting*



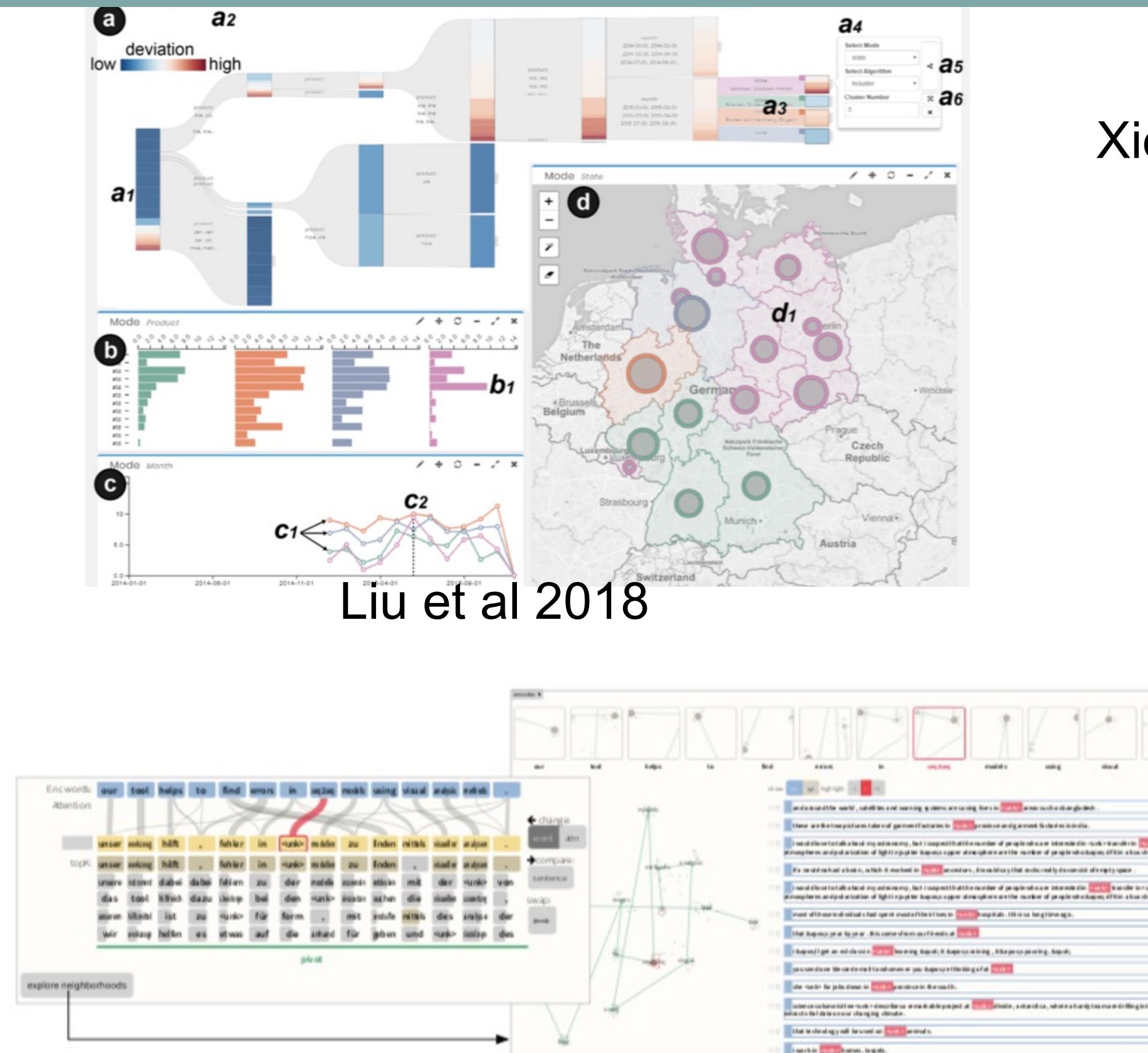
→ Share Data: All/Subset/None



→ Share Navigation

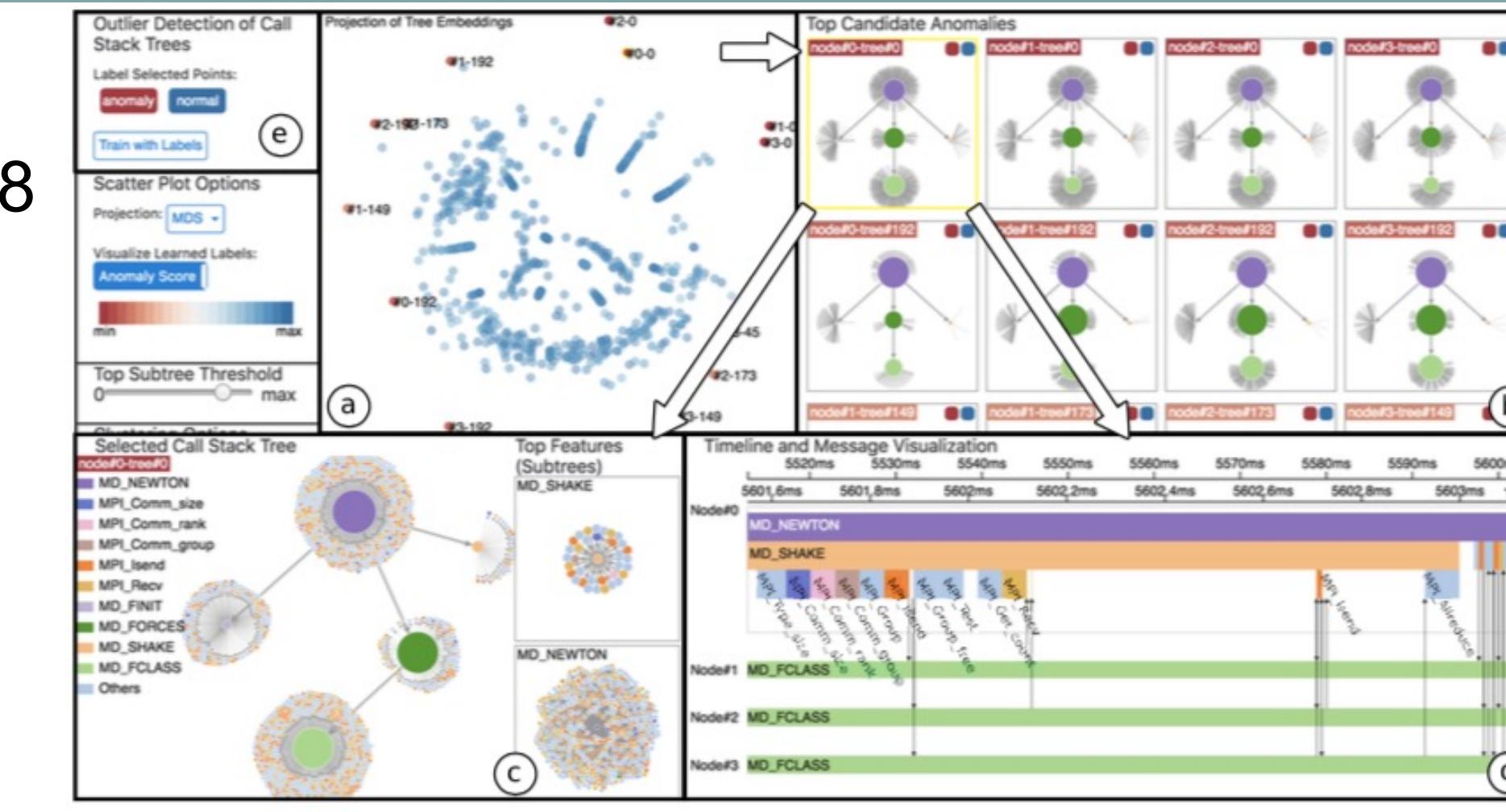


Caveats



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.