Data Visualization (CSCI 627/490)
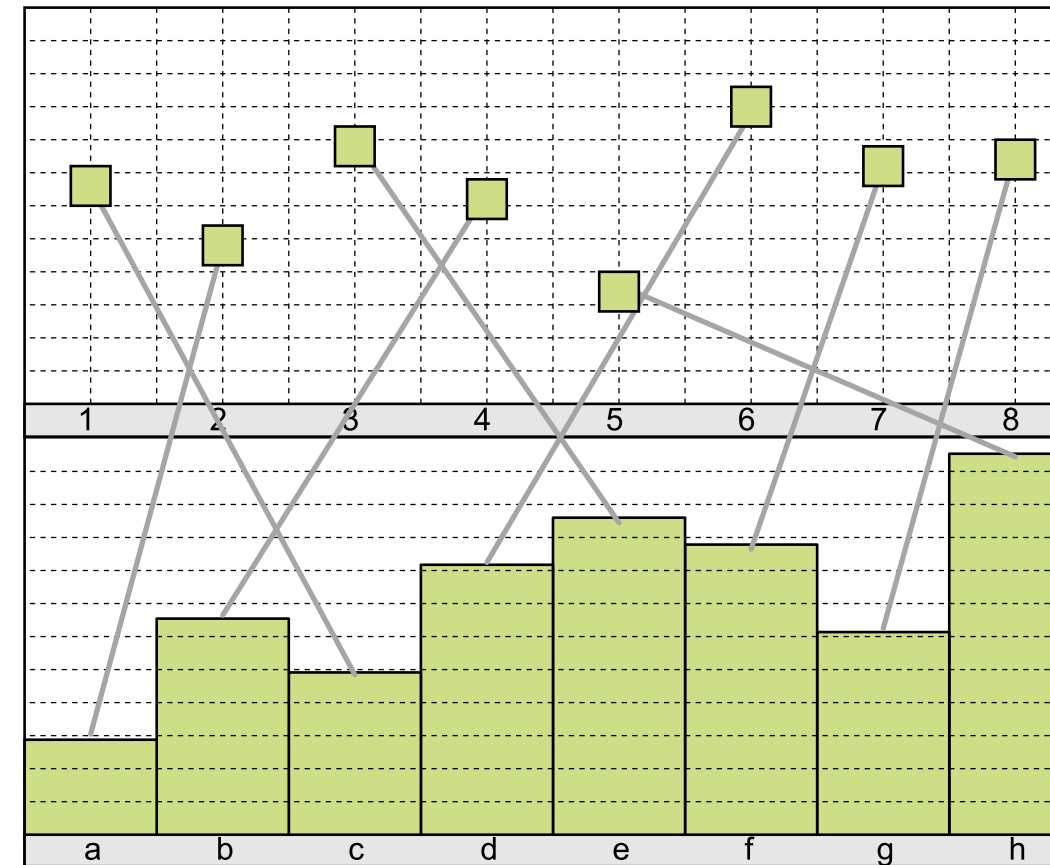
Filtering & Aggregation

Dr. David Koop
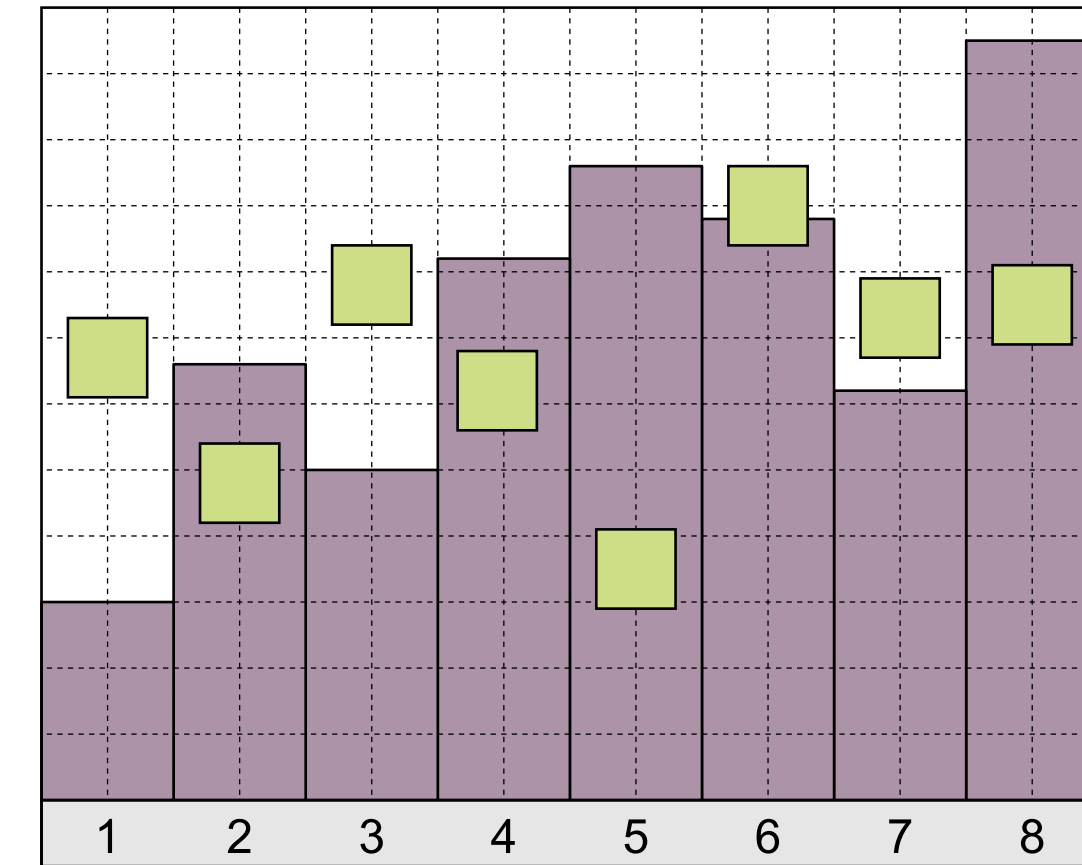
Northern Illinois University

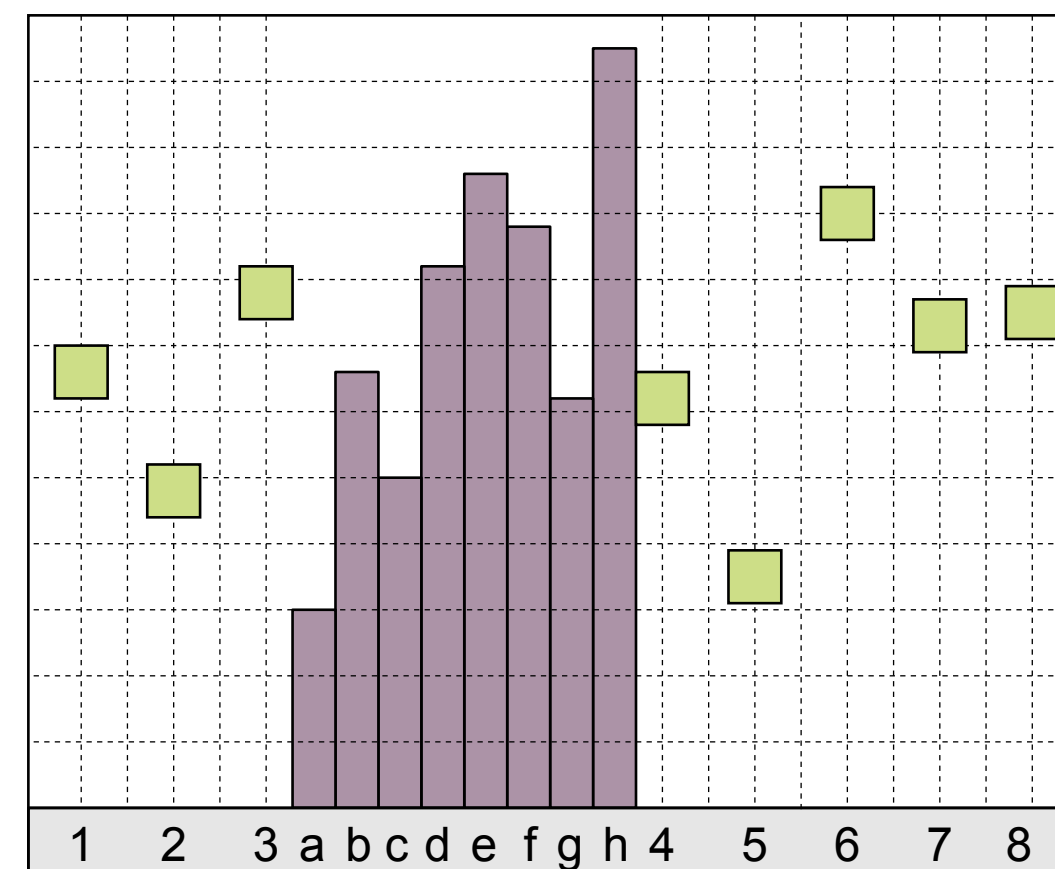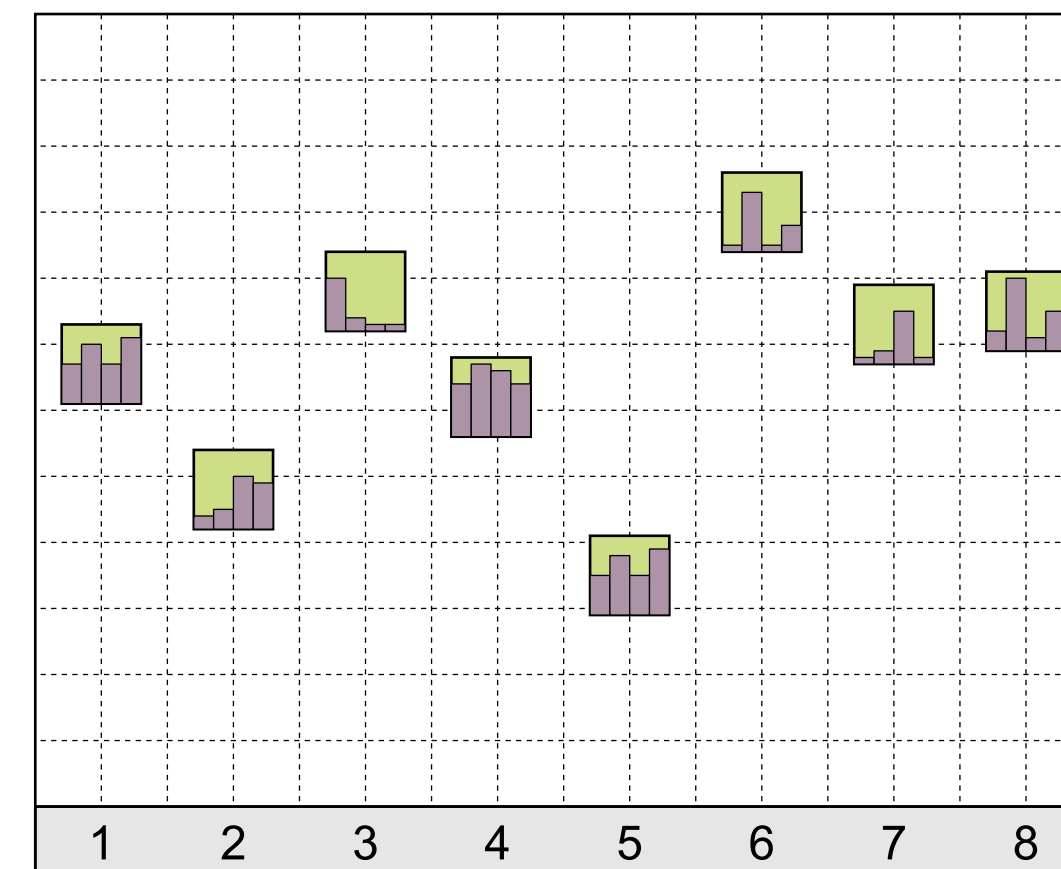# Composite Visualization Techniques
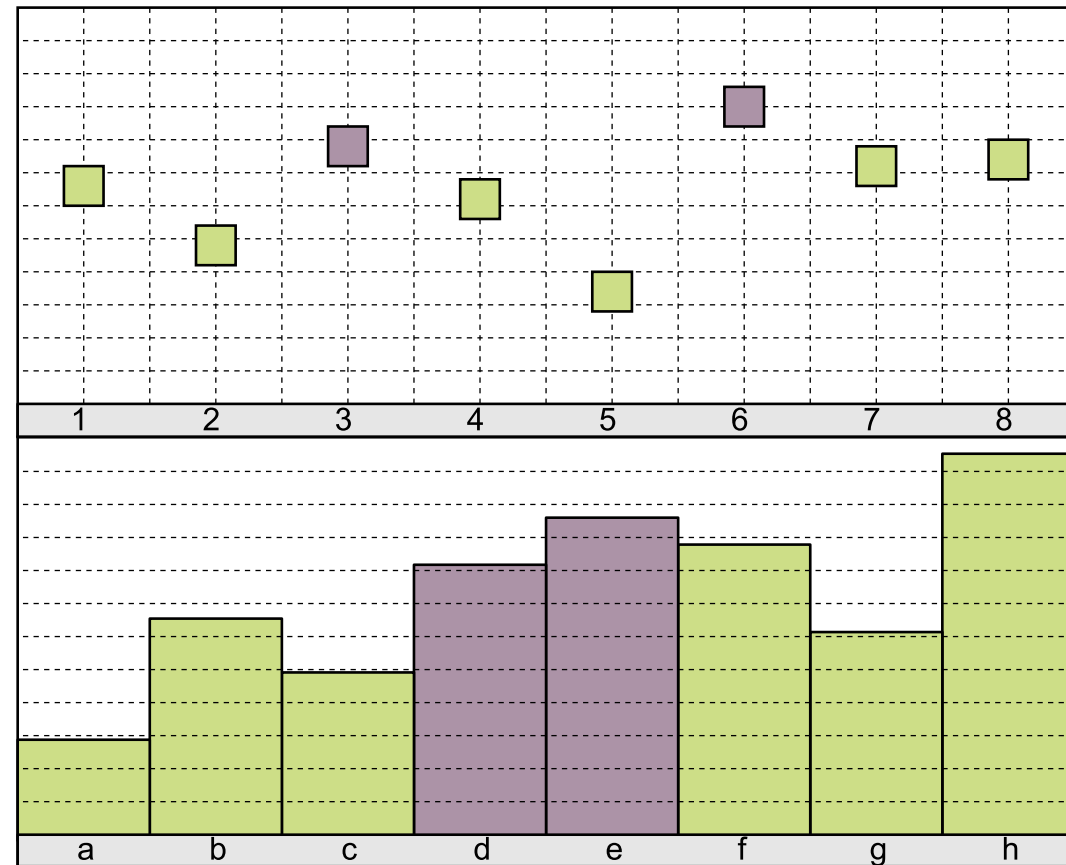
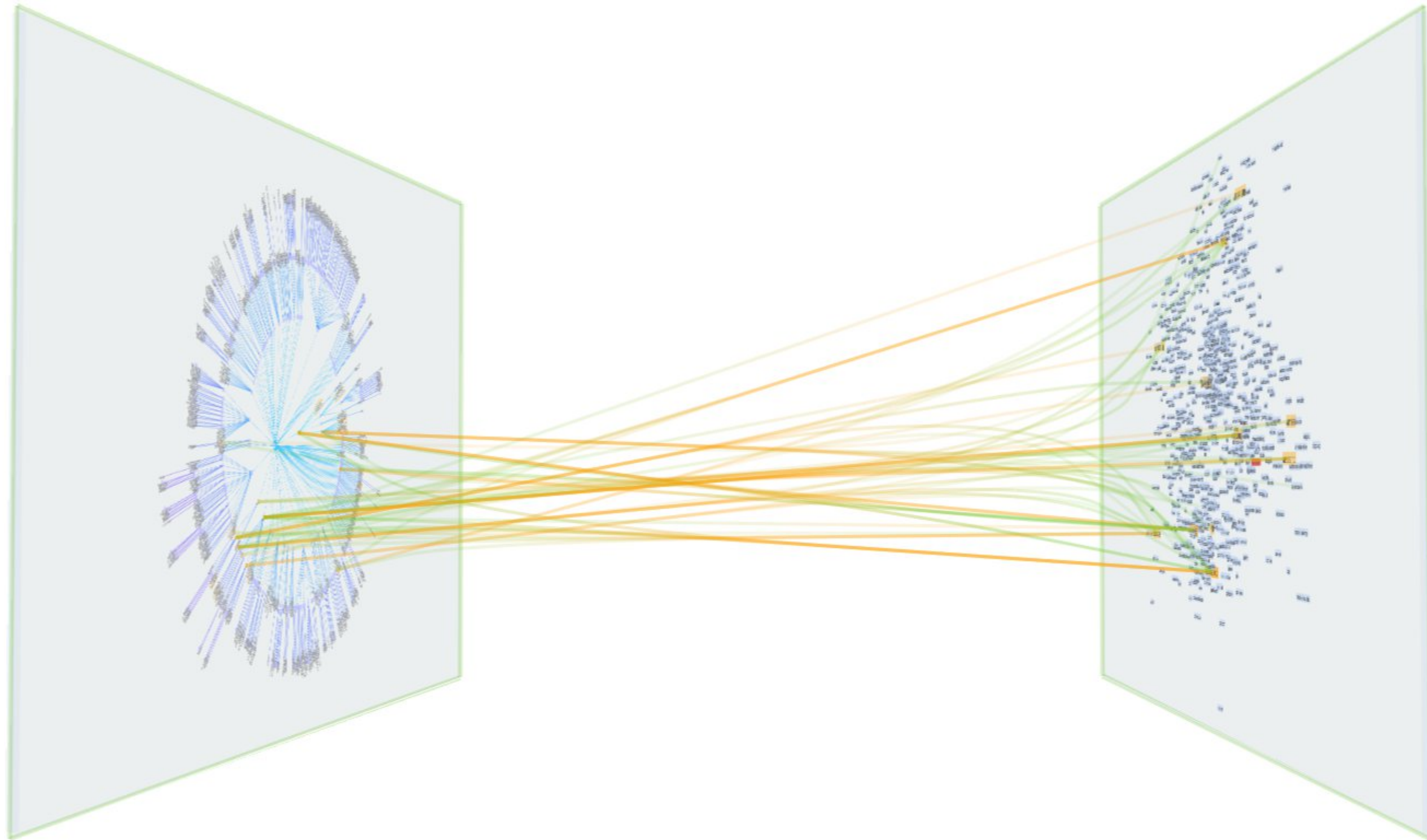(a) Juxtaposed views.

(b) Integrated views.
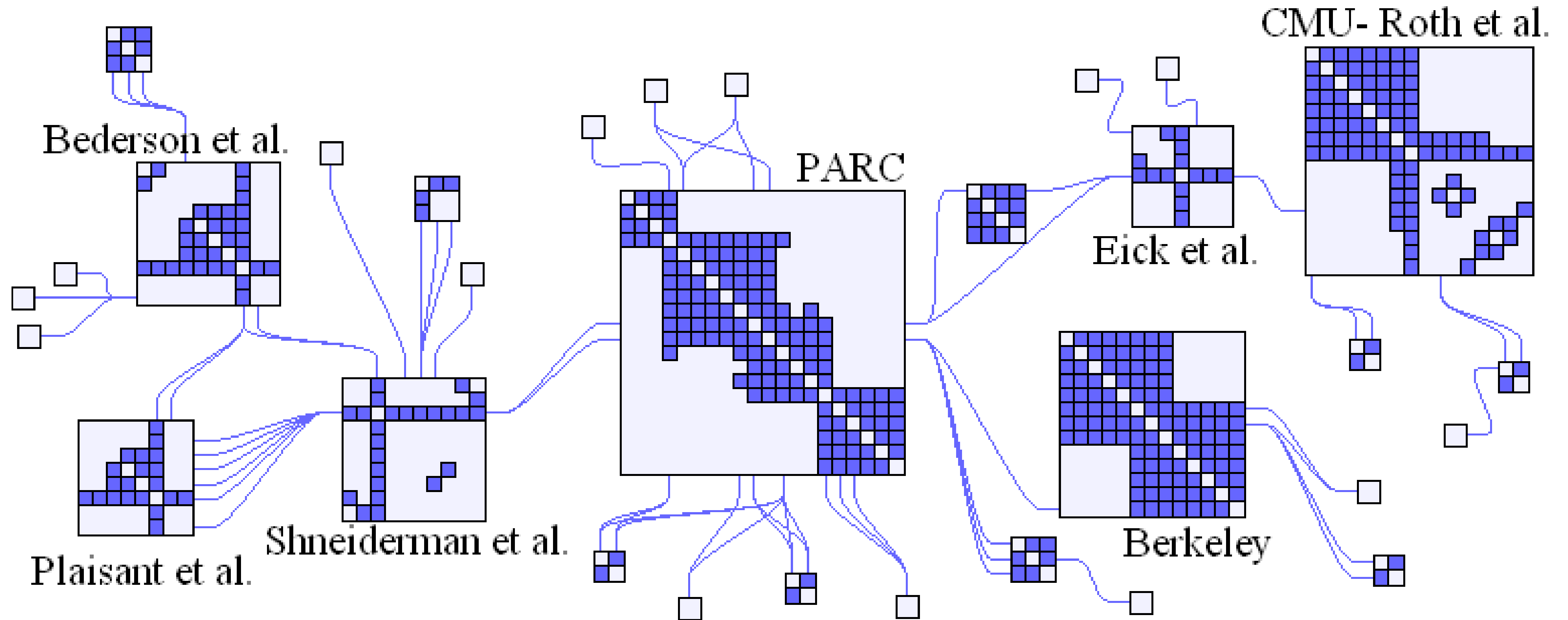
(c) Superimposed views.

(d) Overloaded views.

(e) Nested views.

[W. Javed and N. Elmqvist, 2012]
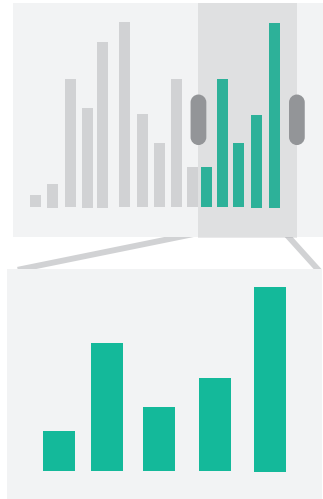
What is this technique?
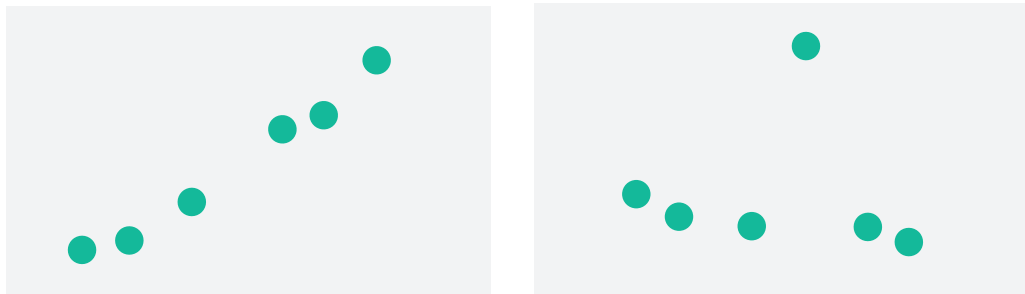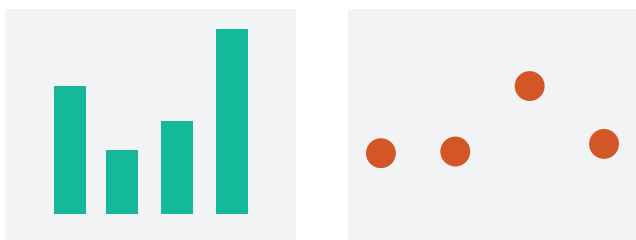
[VisLink, Collins and Carpendale, 2007]

What is this technique?

CMU- Roth et al.

Bederson et al.

PARC

Eick et al.

Plaisant et al.

Shneiderman et al.

Berkeley

[NodeTrix, N. Henry et al., 2007]

Multiple Views

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

Brushing

Adelie   Chinstrap   Gentoo
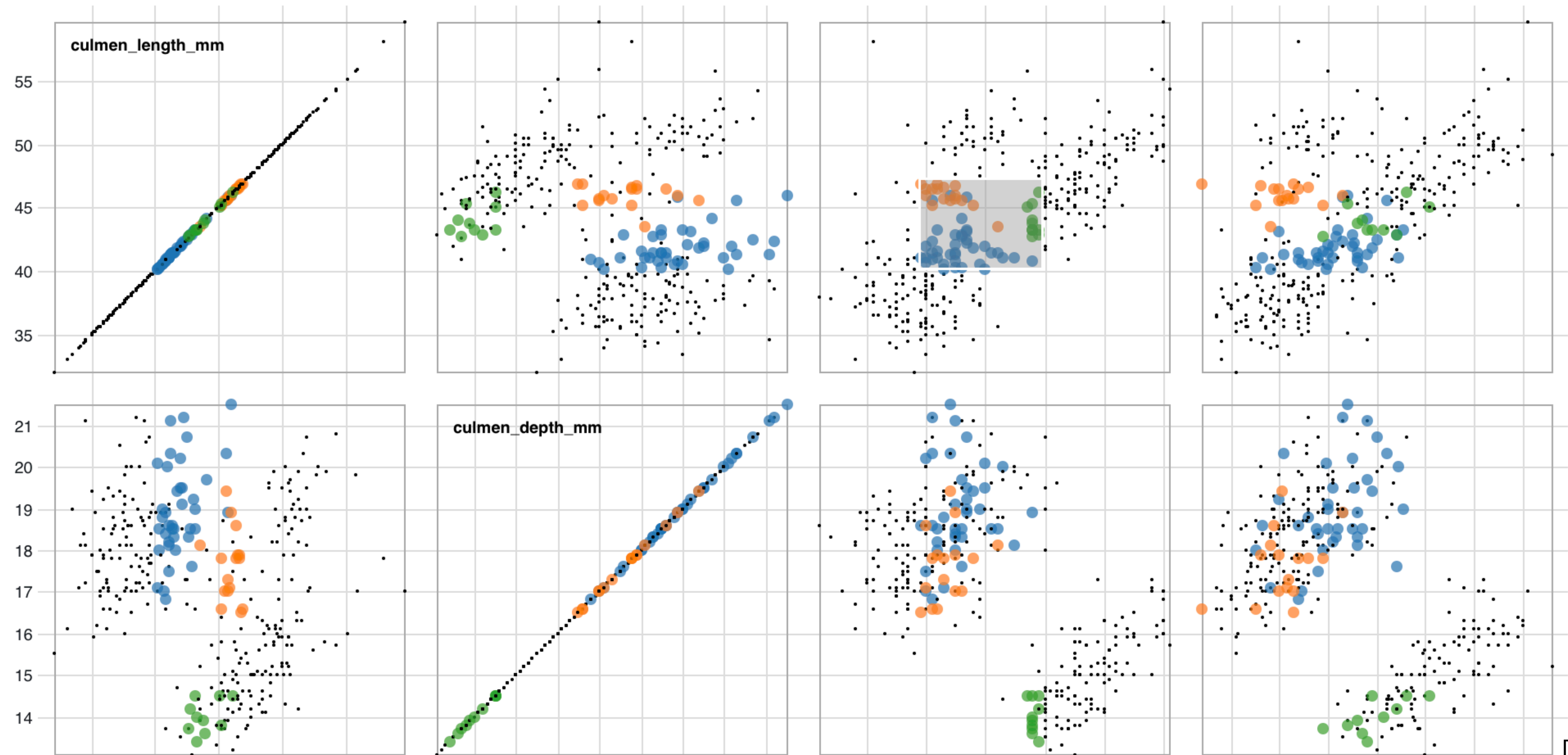
[M. Bostock]

Linked Highlighting Example
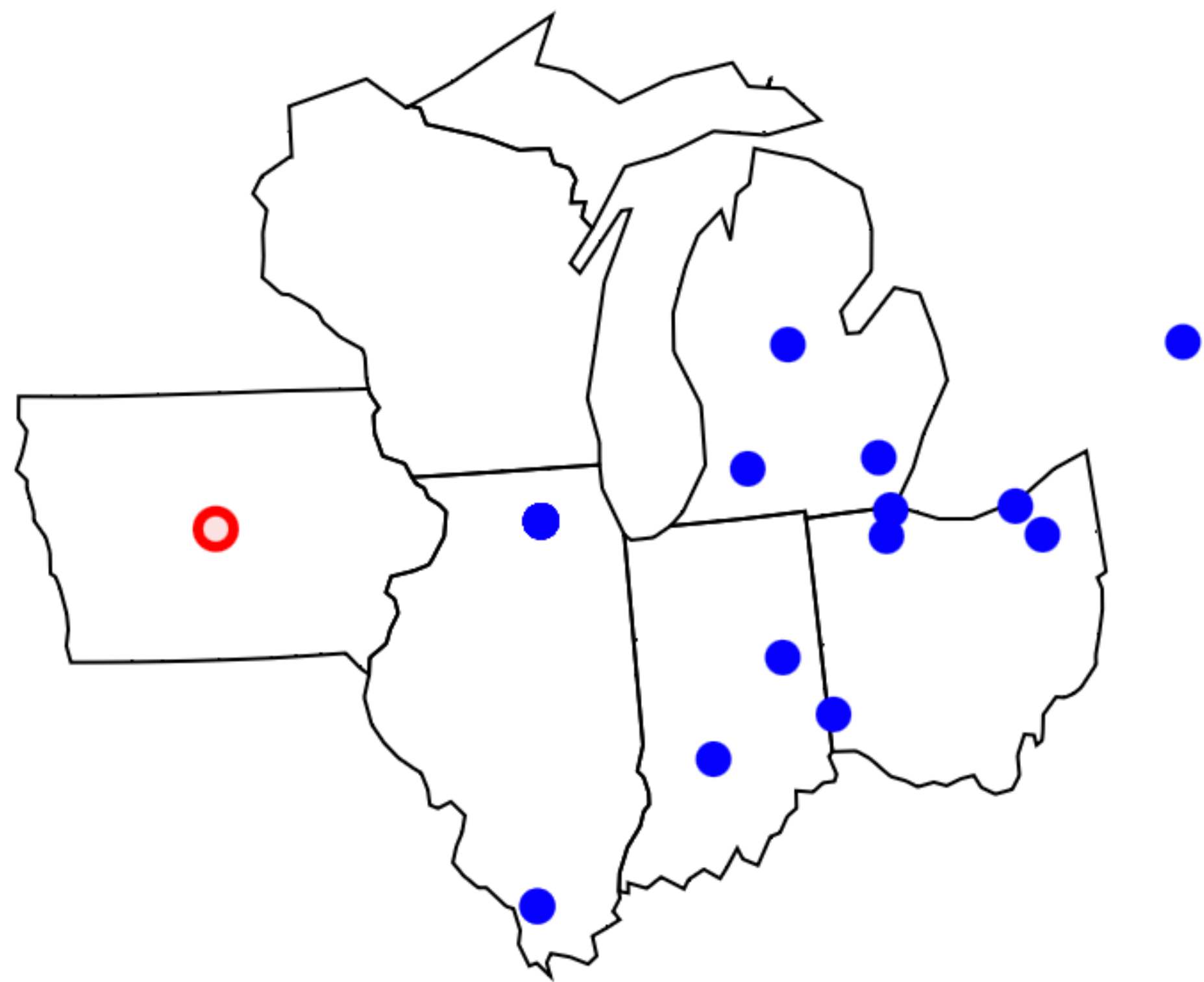
| Date	Opponent	Result	Site
Nov 8, 2018	Yale	W 89–80	DeKalb, IL
Nov 11, 2018	at Iowa State	L 60–70	Ames, IA
Nov 18, 2018	Northern Iowa	W 70–59	DeKalb, IL
Nov 25, 2018	at Indiana	L 73–91	Bloomington, IN
Nov 28, 2018	North Dakota State	W 81–63	DeKalb, IL
Dec 1, 2018	at Montana	L 70–86	Missoula, MT
Dec 2, 2018	vs. Nevada	W 98–69	Missoula, MT
Dec 7, 2018	at Southern Illinois	L 73–82	Carbondale, IL
Dec 8, 2018	vs. Western Illinois	W 86–61	Carbondale, IL
Dec 17, 2018	Eastern Illinois	W 78–59	DeKalb, IL
Dec 21, 2018	Chicago State	W 114–52	DeKalb, IL
Dec 31, 2018	Brown	W 109–102	DeKalb, IL
Jan 5, 2019	Miami (OH)	W 82–71	DeKalb, IL
Jan 9, 2019	at Kent State	L 78–87	Kent, OH

Multiform & Small Multiples
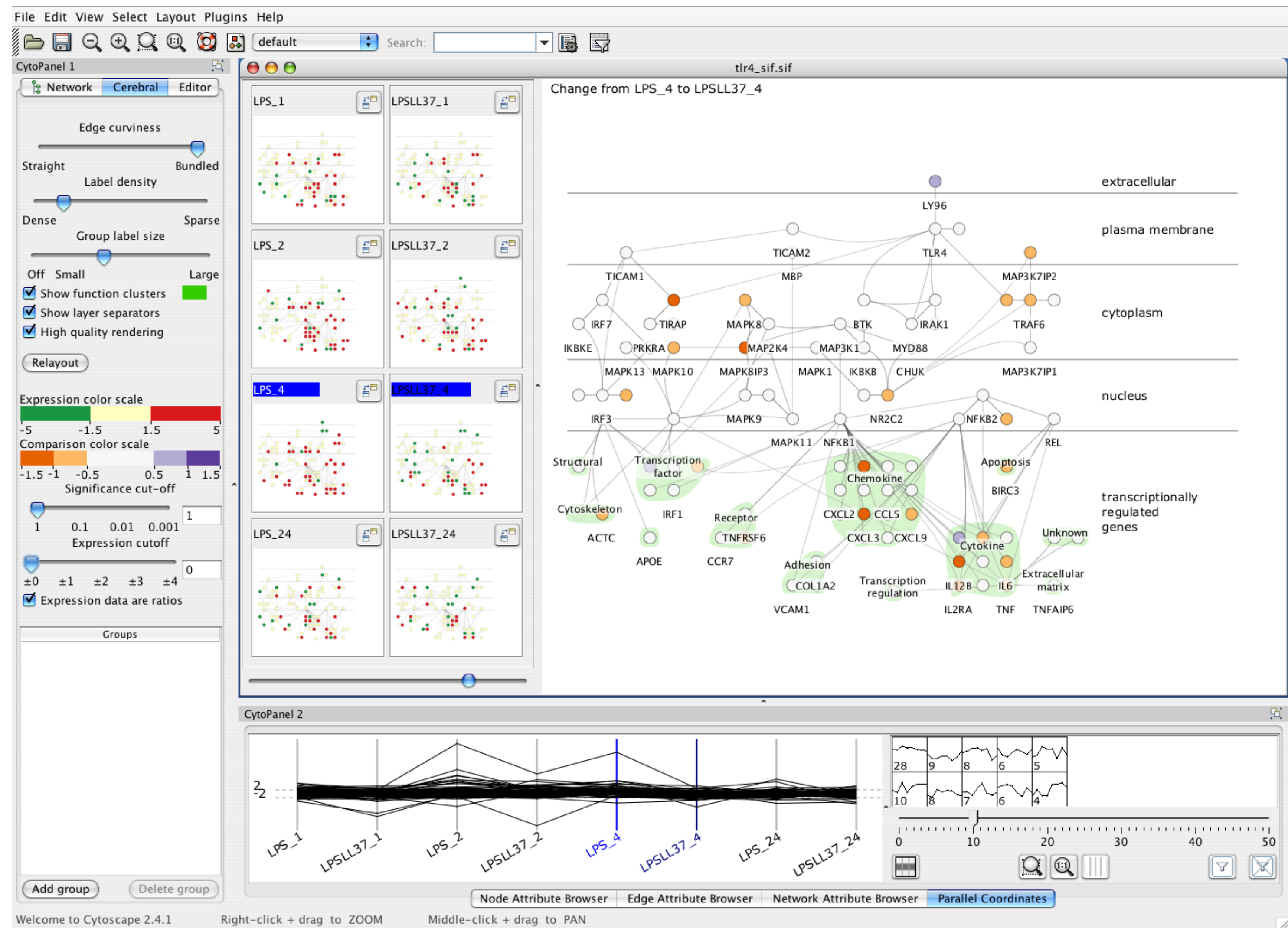
[Barsky et al., 2008]
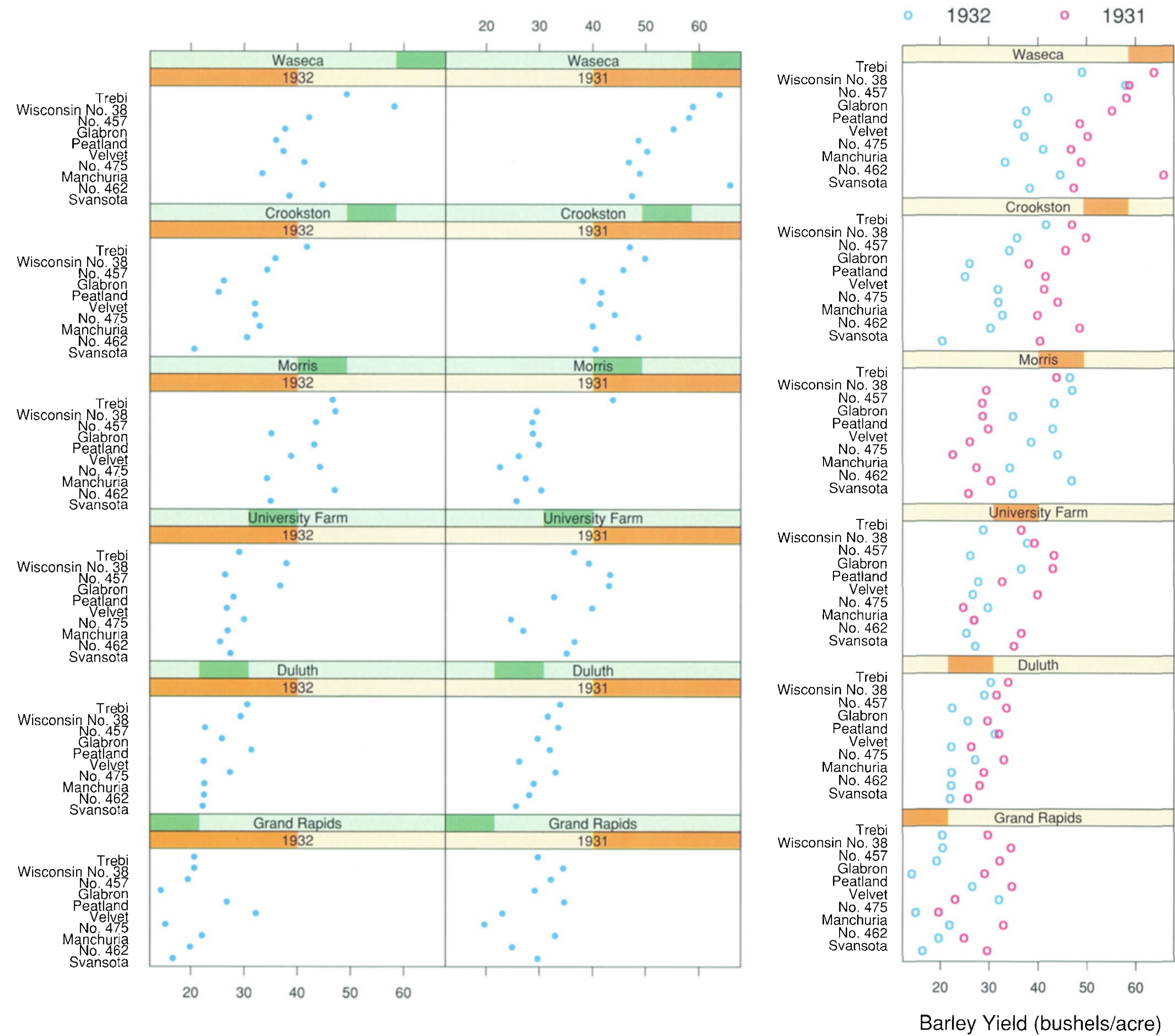
Glyphs, Views, and Regions

- Glyphs are composed of multiple marks

- Views are a contiguous region of space

- A region is usually associated with a group of data

- Blurry lines of distinction between them
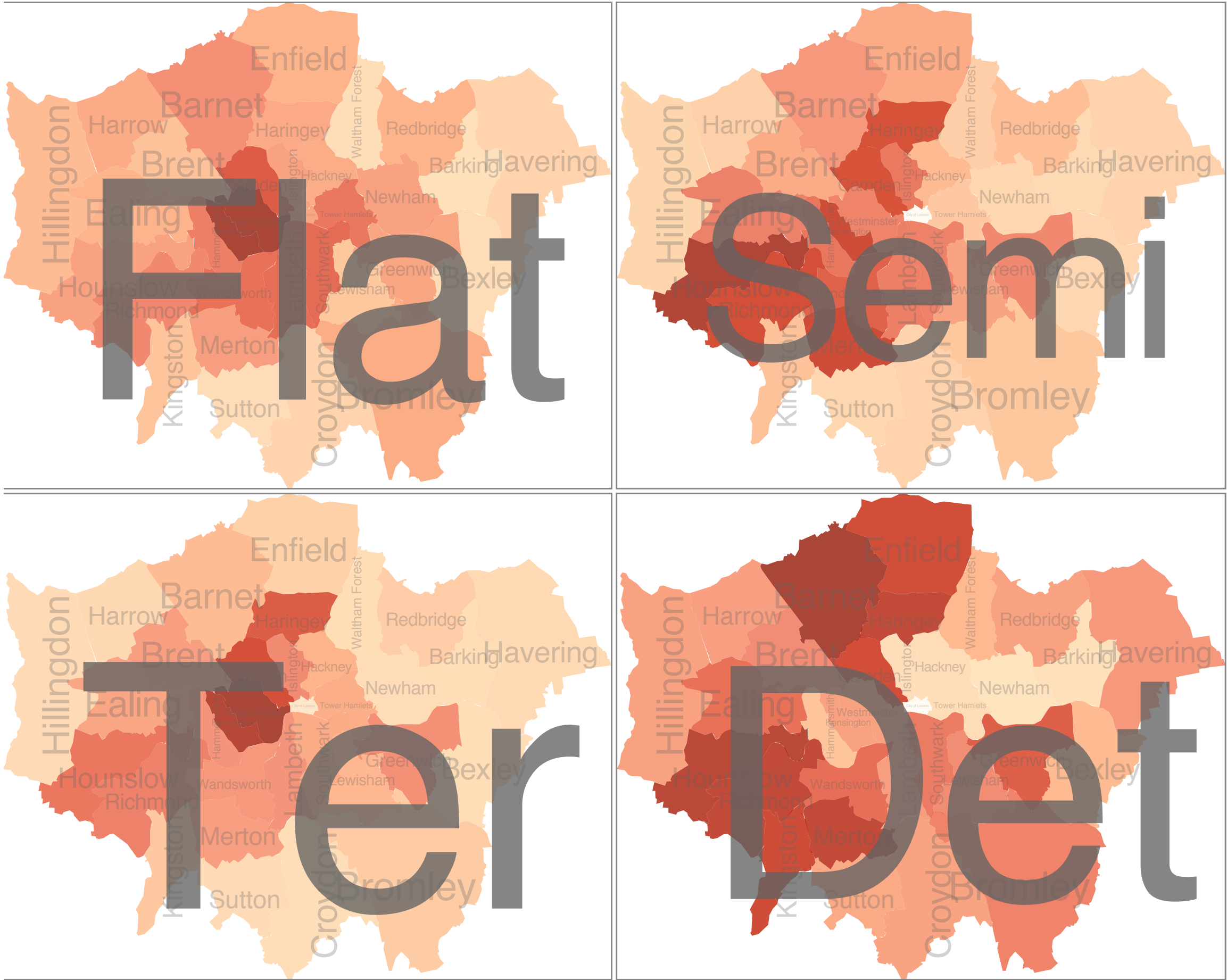
Example: Small Multiples Bar Chart
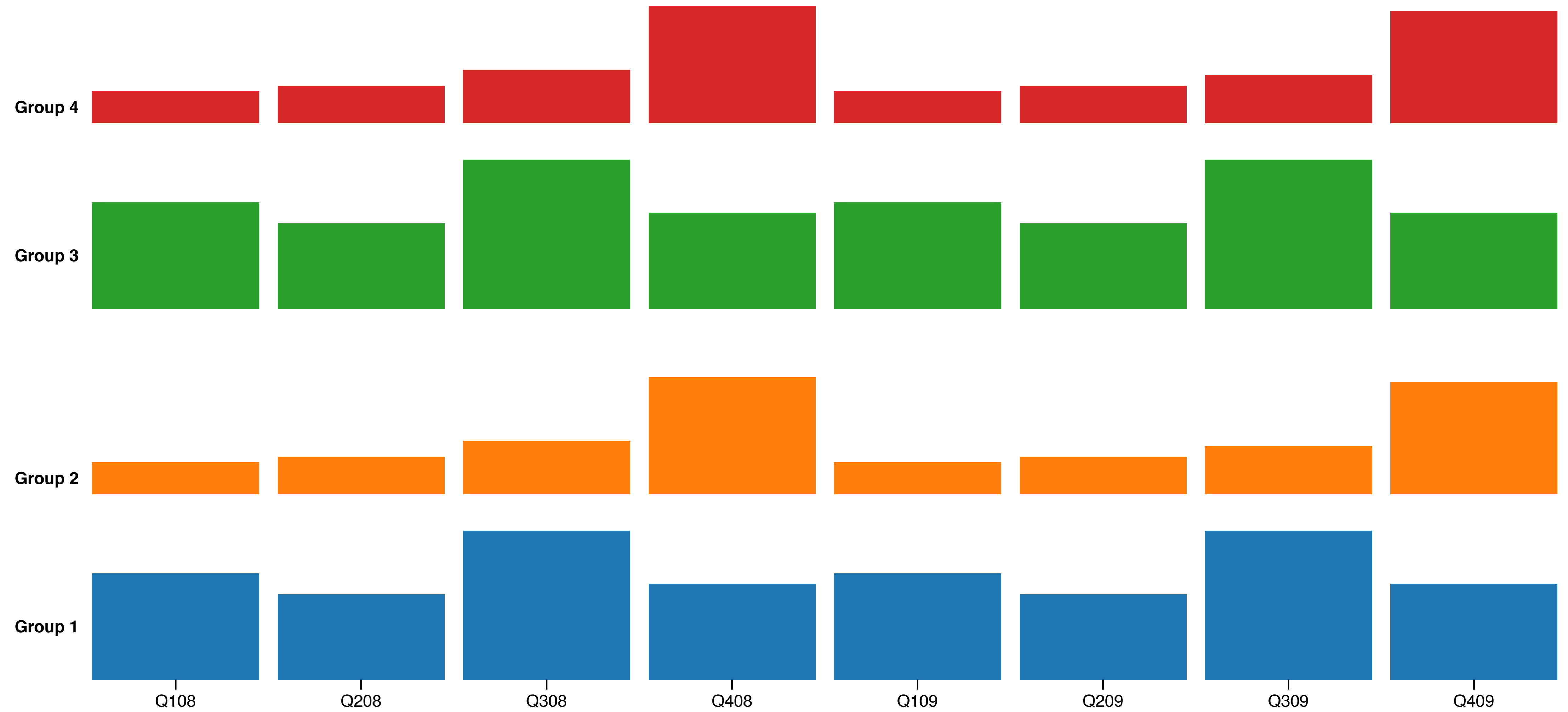
[M. Bostock]

Matrix Alignment

[Becker et al., 1996]

Recursive Subdivision

[Slingsby et al., 2009]

Assignment 5

- Focus on Multiple Views and Interaction
- Soon…

Project Design

- Feedback:

  - Data Manipulation?

  - Questions lead, not technique!

  - Be creative! (interaction too) https://xeno.graphics

- Work on turning your visualization ideas into designs

- Turn in:

  - Three Designs Sketches, including one bad design

  - Progress on Implementation

- Due Friday, Nov. 15

Reducing Complexity

Reducing Complexity

- Too many items or attributes lead to visual clutter
- Interaction and Multiple Views can help, but often lose the ability to start understanding an entire dataset at first glance
- **Reduction** techniques show less data to reduce complexity
- Can reduce items or attributes (both are **elements**)
- **Filtering**: eliminate elements from the current view
  - "out of sight, out of mind"
- **Aggregation**: replace elements with a new element that represents the replaced elements
  - summarization is often challenging to design
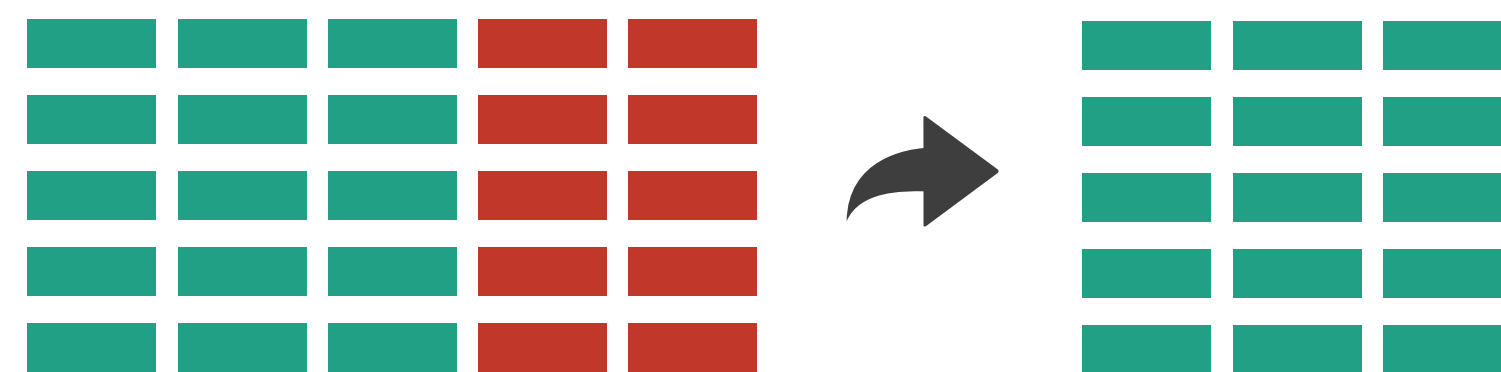- Another method is **focus+context**: show details in the context of an overview
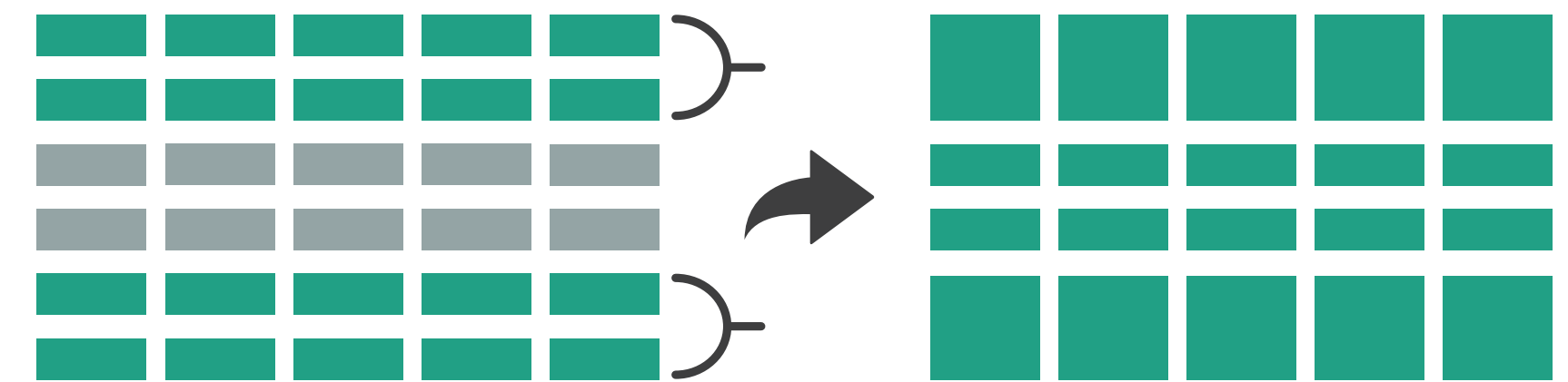
Overview: Reducing Items & Attributes

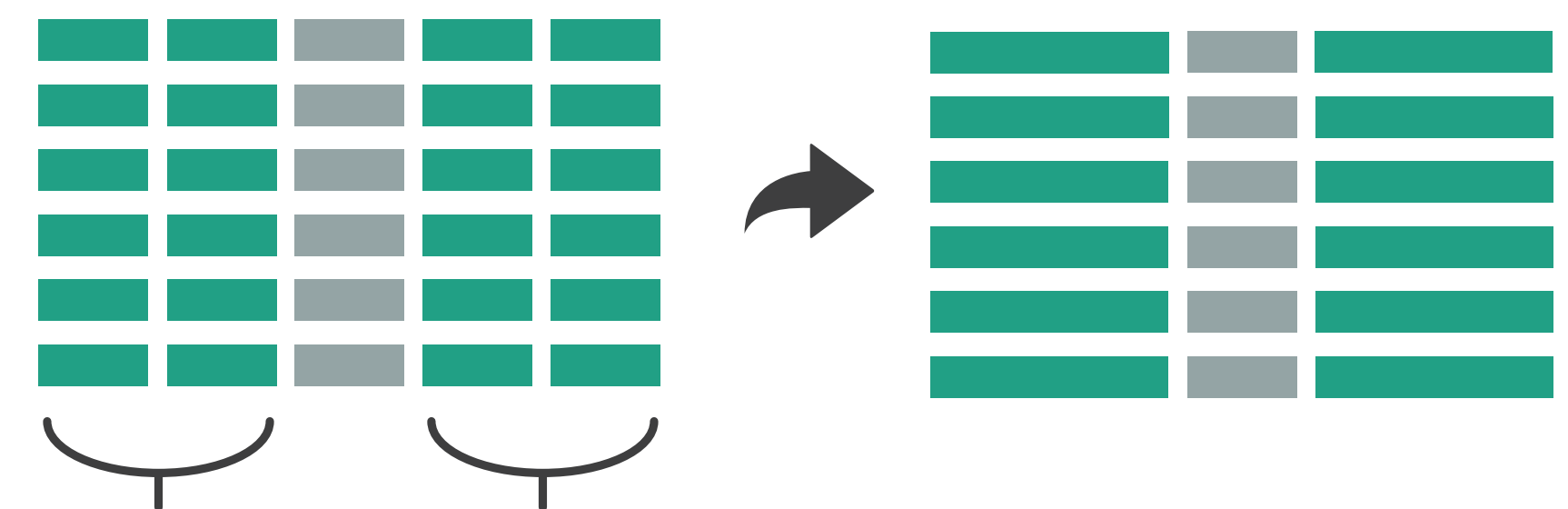
→ Filter

→ Items
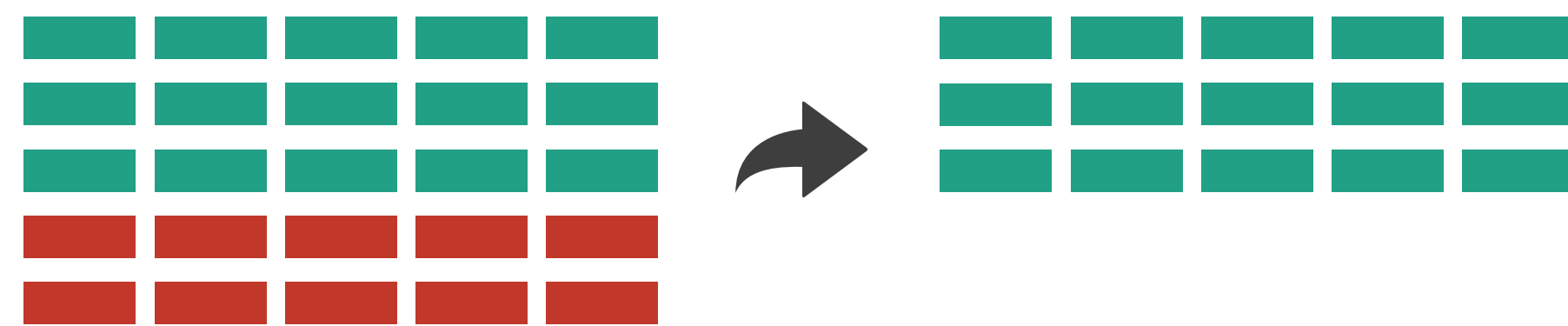
→ Attributes

→ Aggregate

→ Items

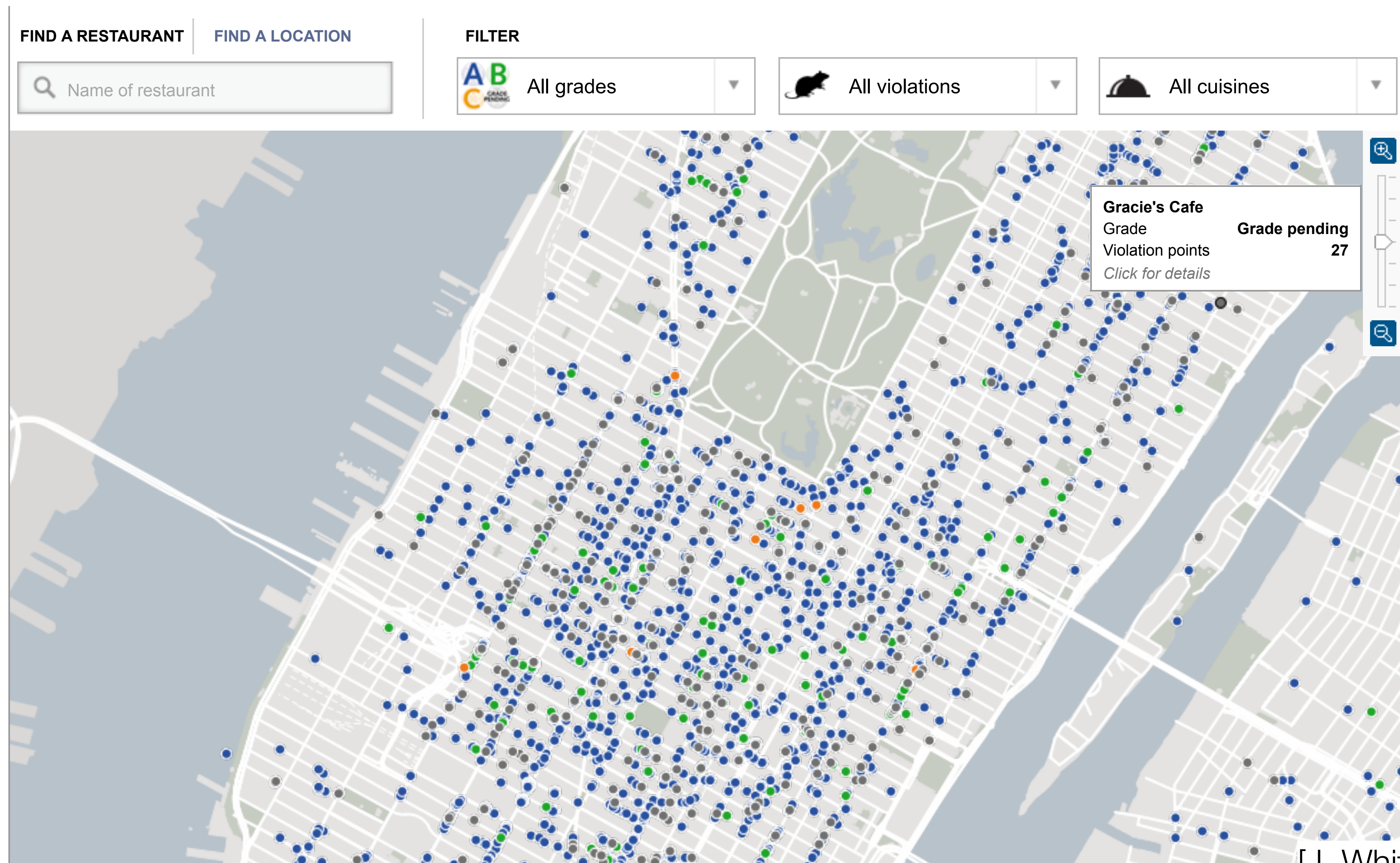→ Attributes

[Munzner (ill. Maguire), 2014]

Filtering

- Just don't show certain elements

- Item filtering: most common, eliminate marks for filtered items

- Attribute filtering:

  - attributes often mapped to different channels

  - if mapped to same channel, allows many attributes (e.g. parallel coordinates, star plots), can filter

- How to specify which elements?

  - Pre-defined rules

  - User selection

Filter vs. Query

- Queries start with an empty set of items and **add** items
- Filters start with all items and **remove** items

# Example: NYC Health Dept. Restaurant Ratings

[J. White, New York Times]

Dynamic Filters

- Interaction need not be with the visualization itself
- Users interact with **widgets** that control which items are shown
  - Sliders, Combo boxes, Text Fields
- Often tied to attribute values
- Examples:
  - All restaurants with an "A" Grade
  - All pizza places
  - All pizza places with an "A" Grade

# Scented Widgets
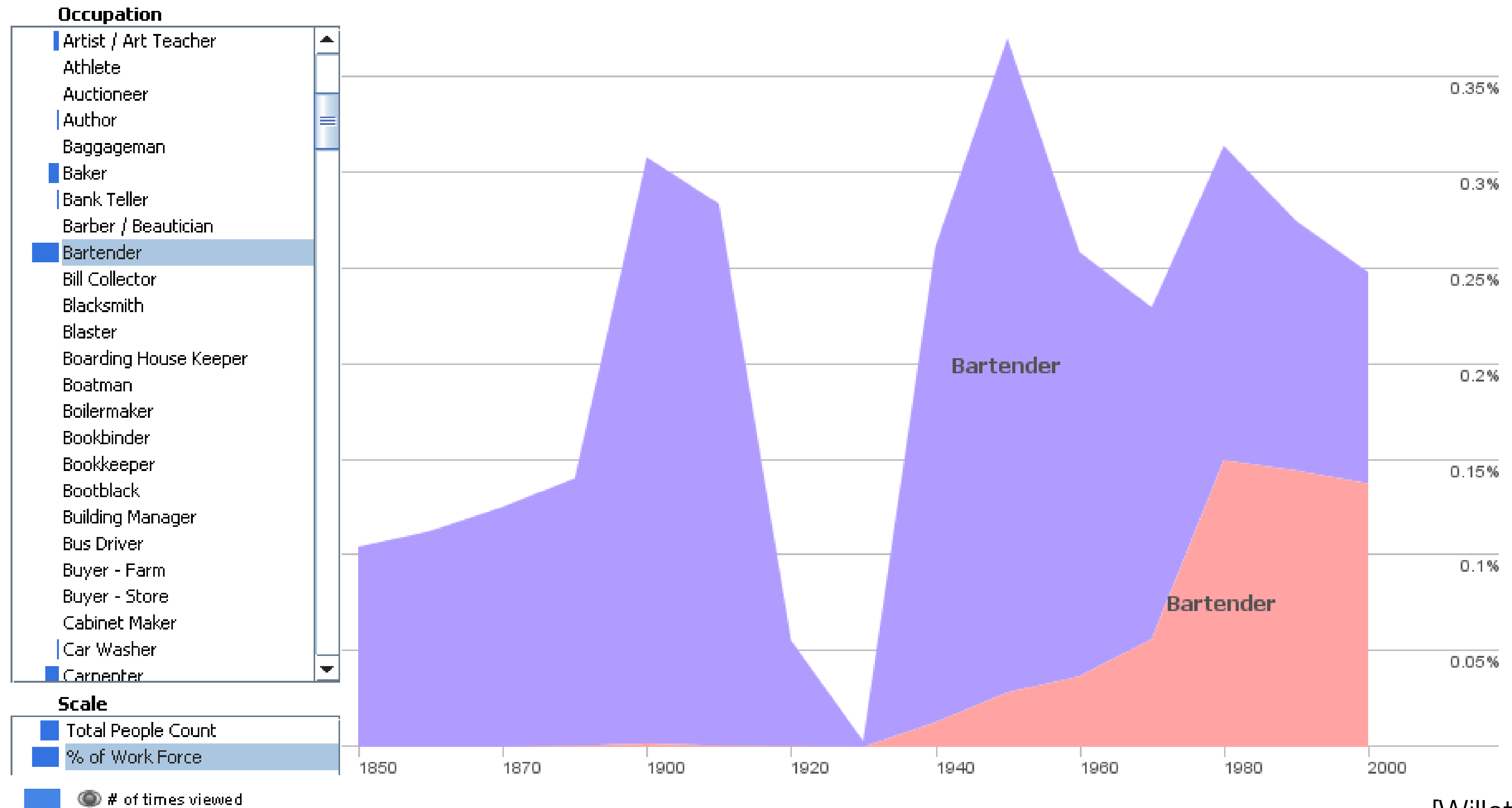
[Willett et al., 2007]

Scented Widgets
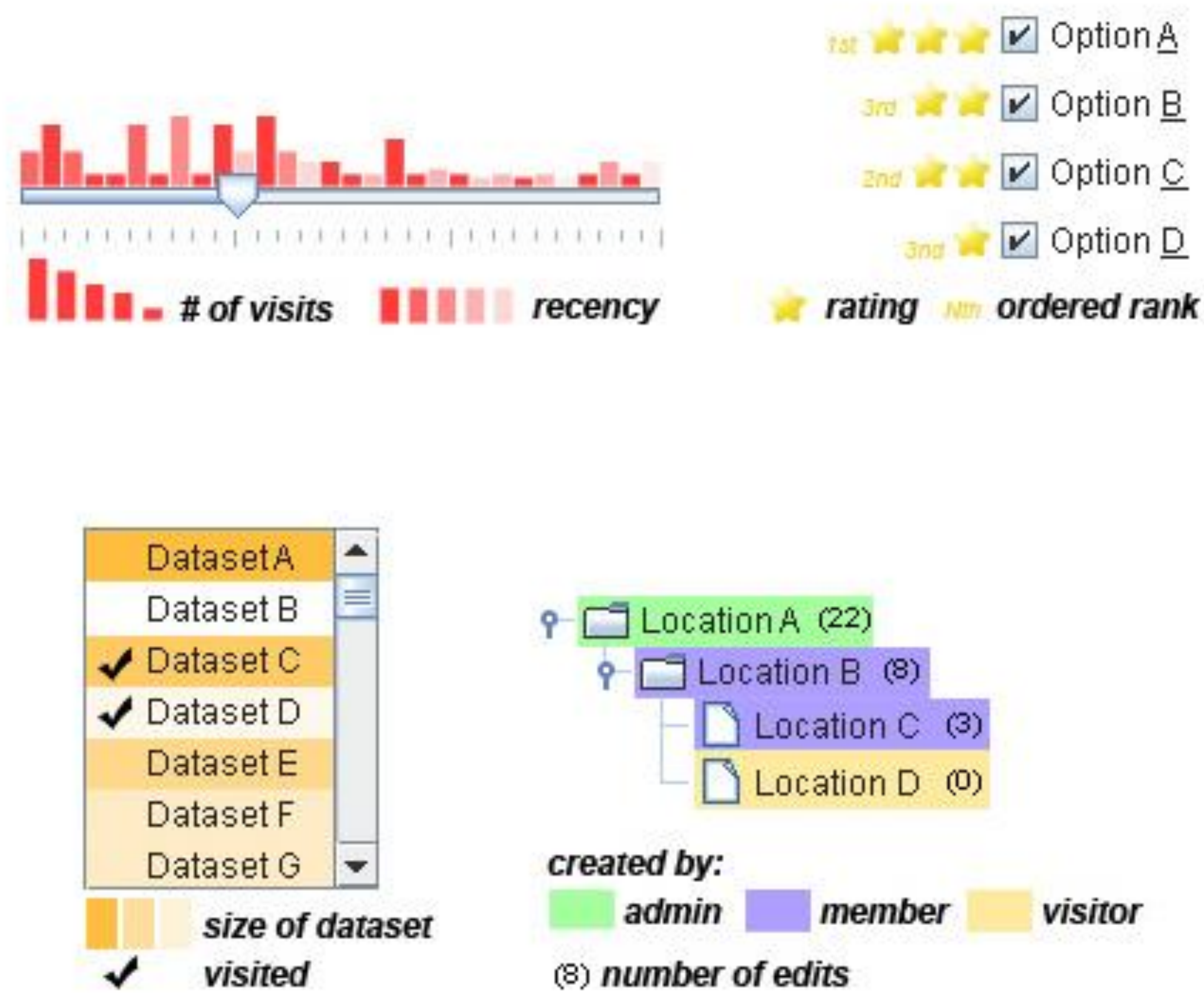
| Name	Description	Example
Hue	Varies the hue of the widget (or of a visualization embedded in it)	
Saturation	Varies the saturation of the widget (or of a visualization embedded in it)	
Opacity	Varies the saturation of the widget (or of a visualization embedded in it)	
Text	Inserts one or more small text figures into the widget	
Icon	Inserts one or more small icons into the widget.	
Bar Chart	Inserts one or more small bar chart visualizations into the widget	
Line Chart	Inserts one or more small line chart visualizations into the widget	

[Willett et al., 2007]

Star Plots (aka Radar Charts)
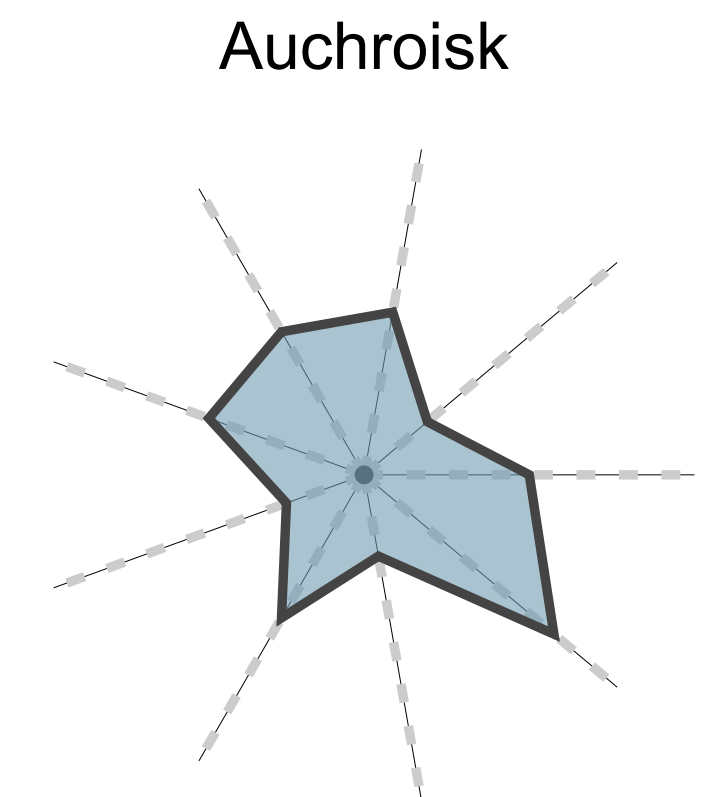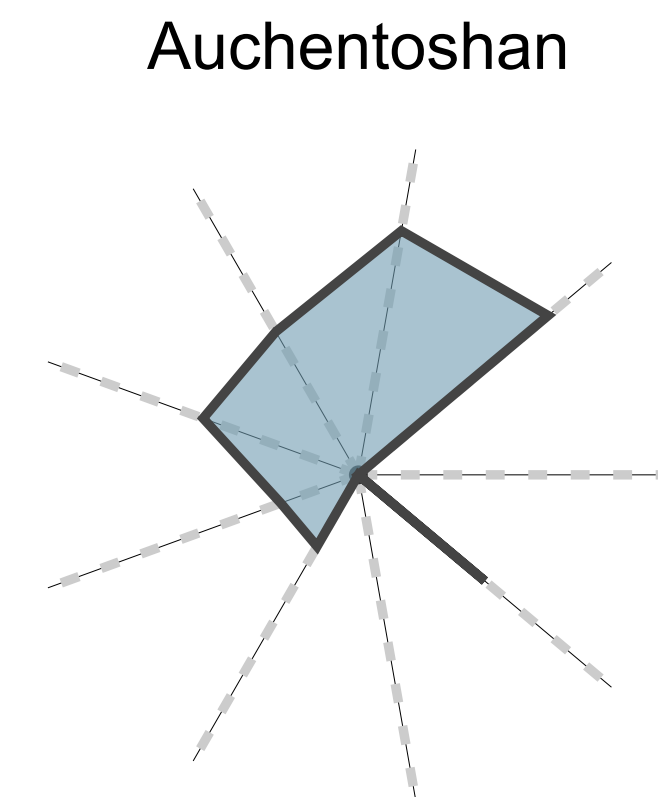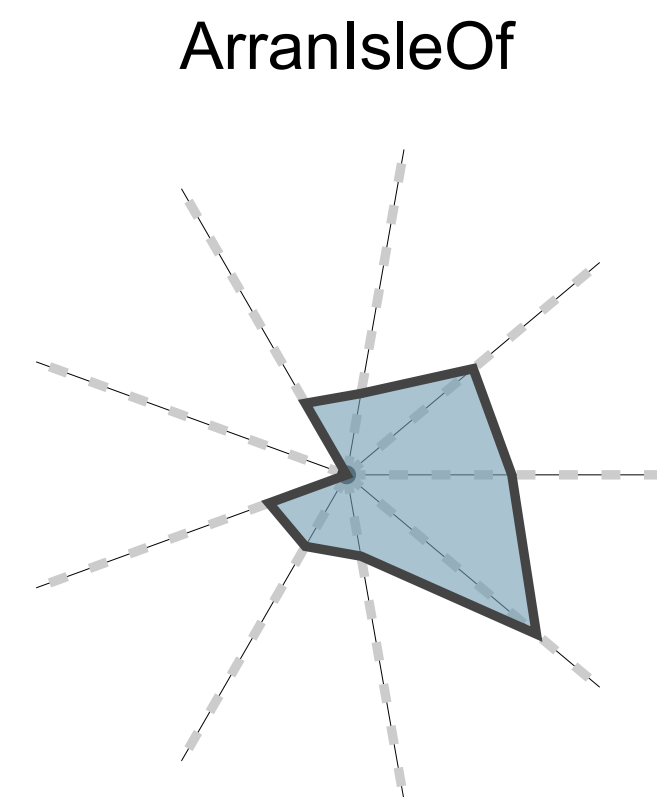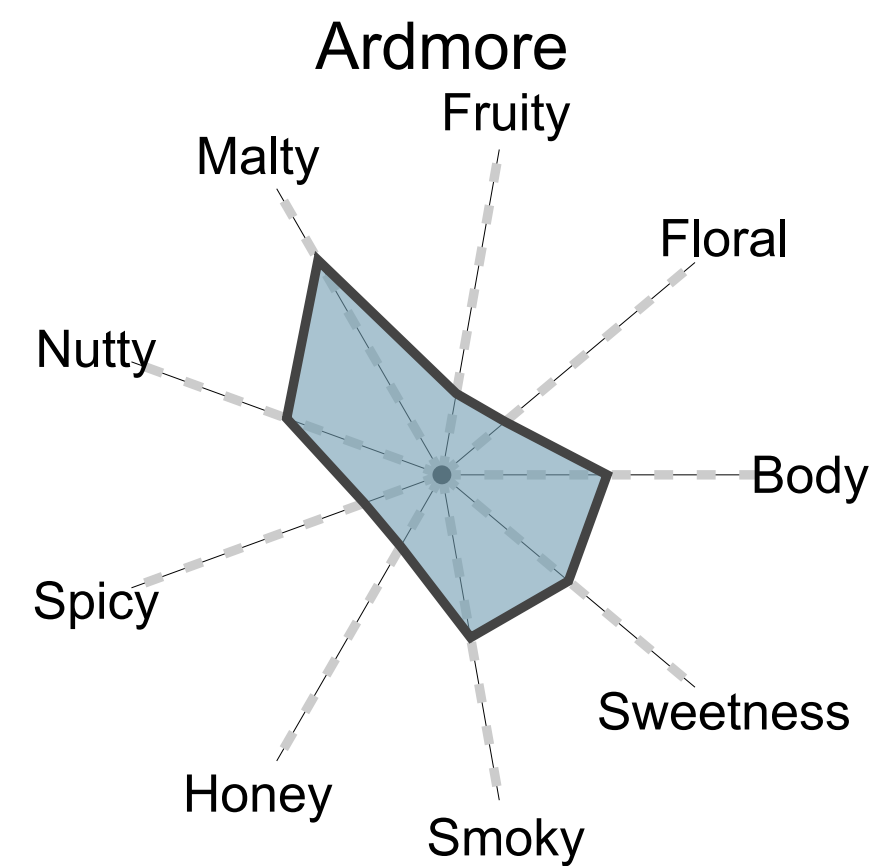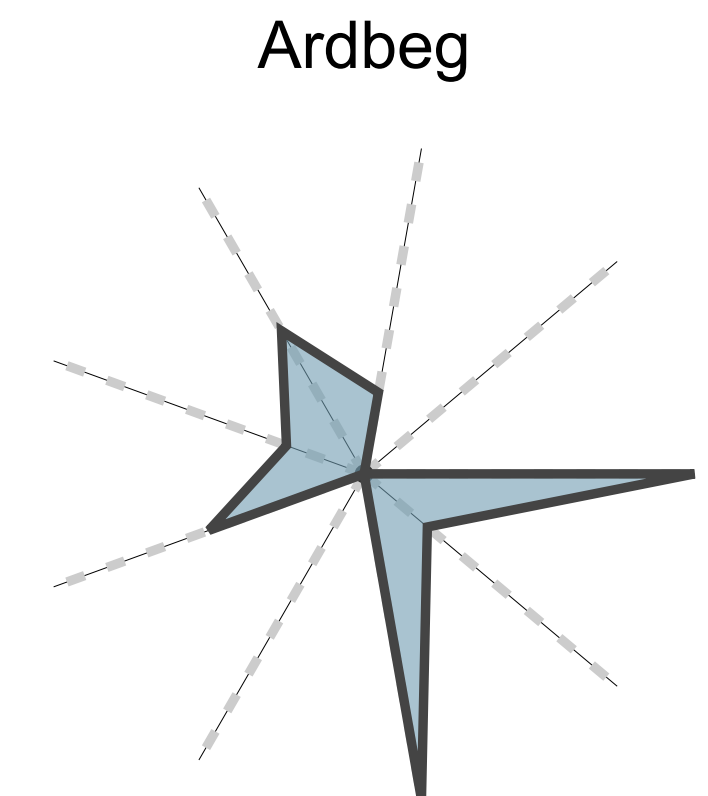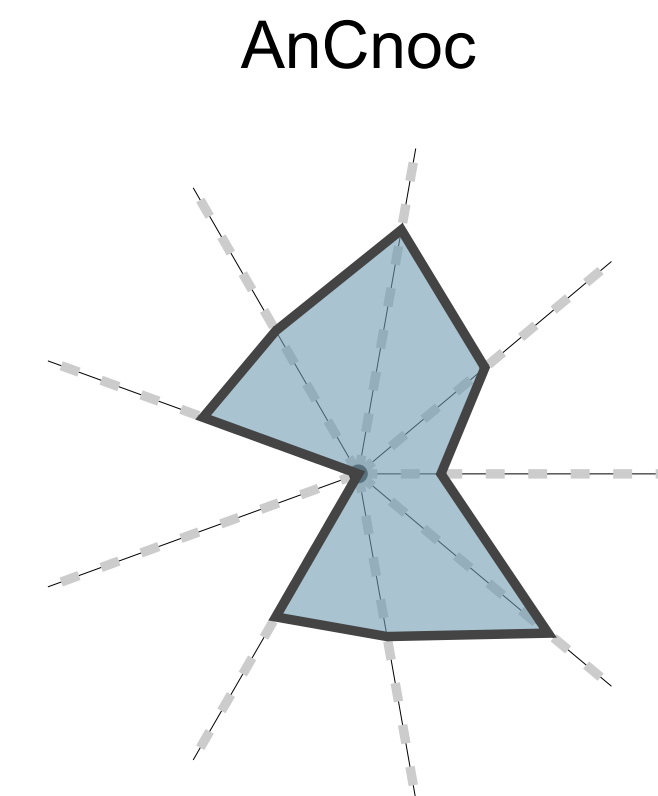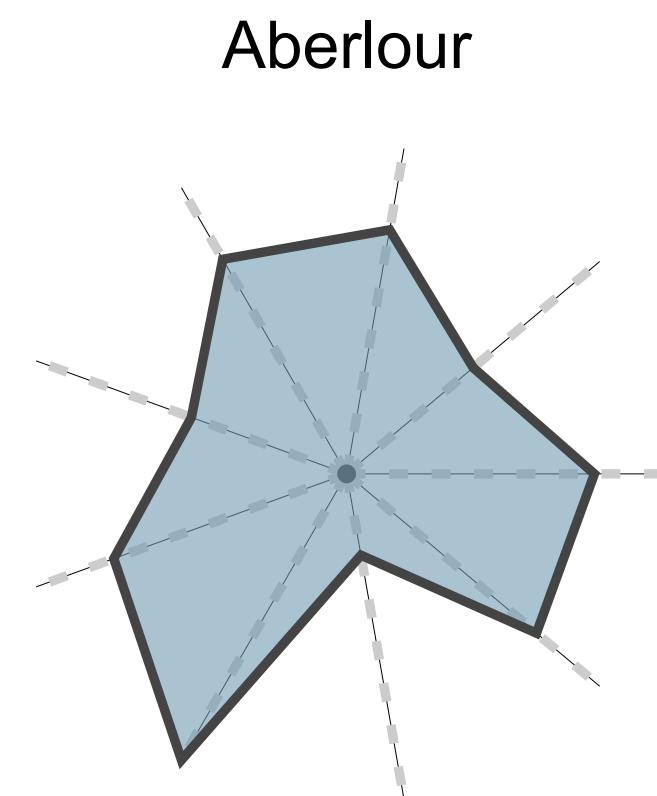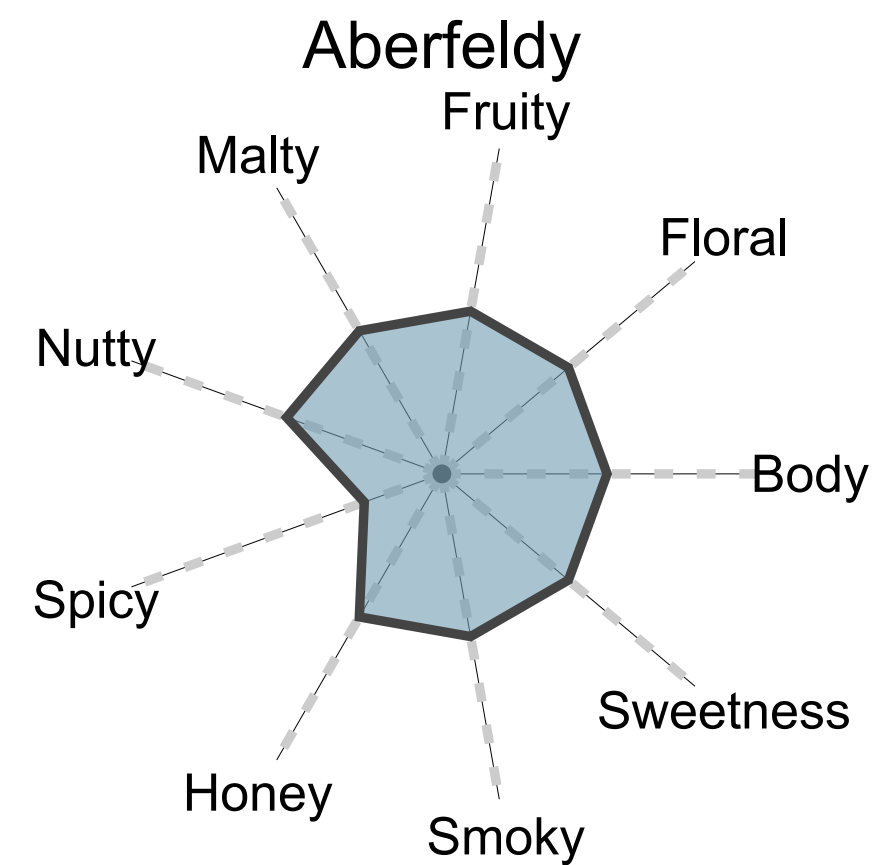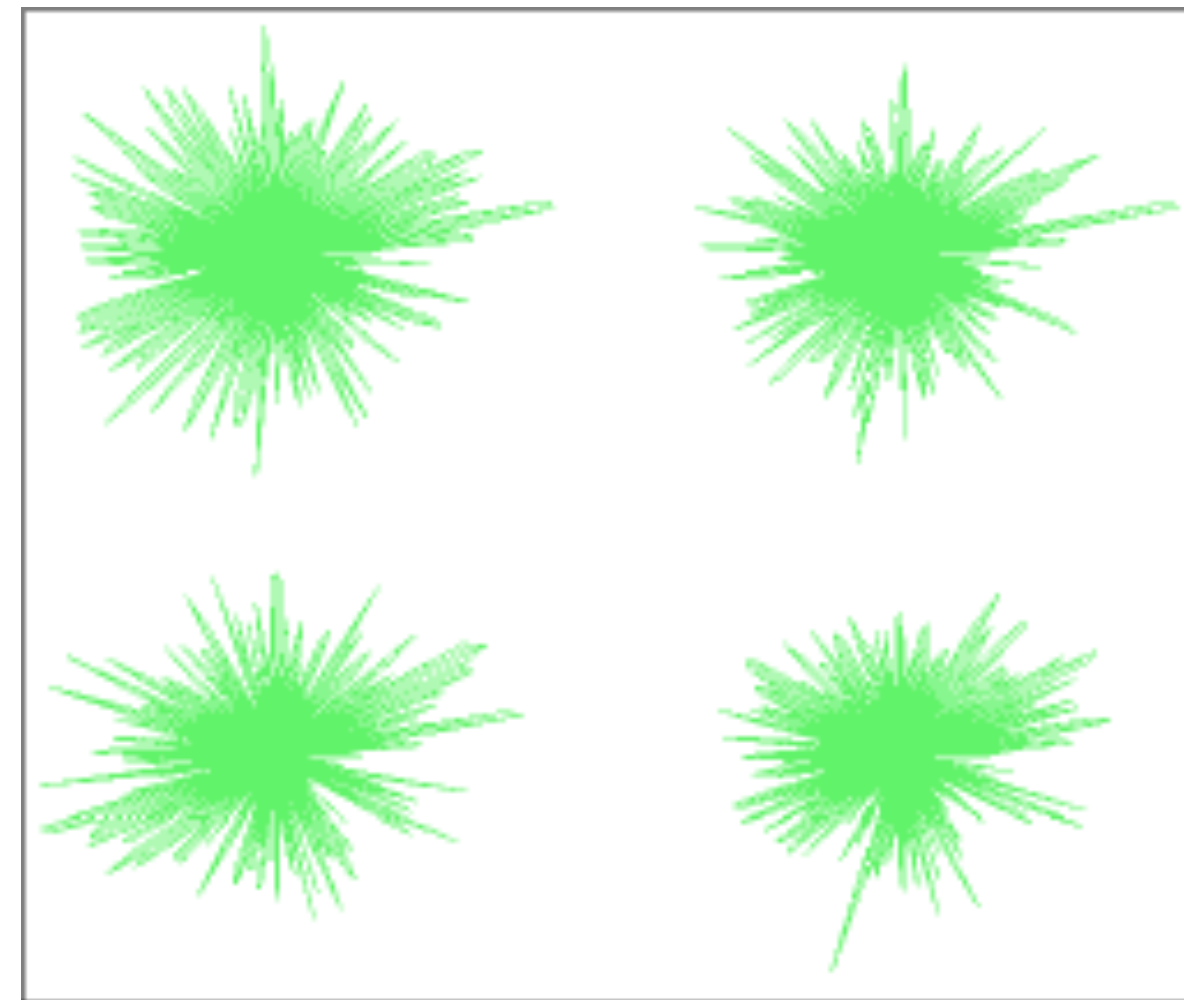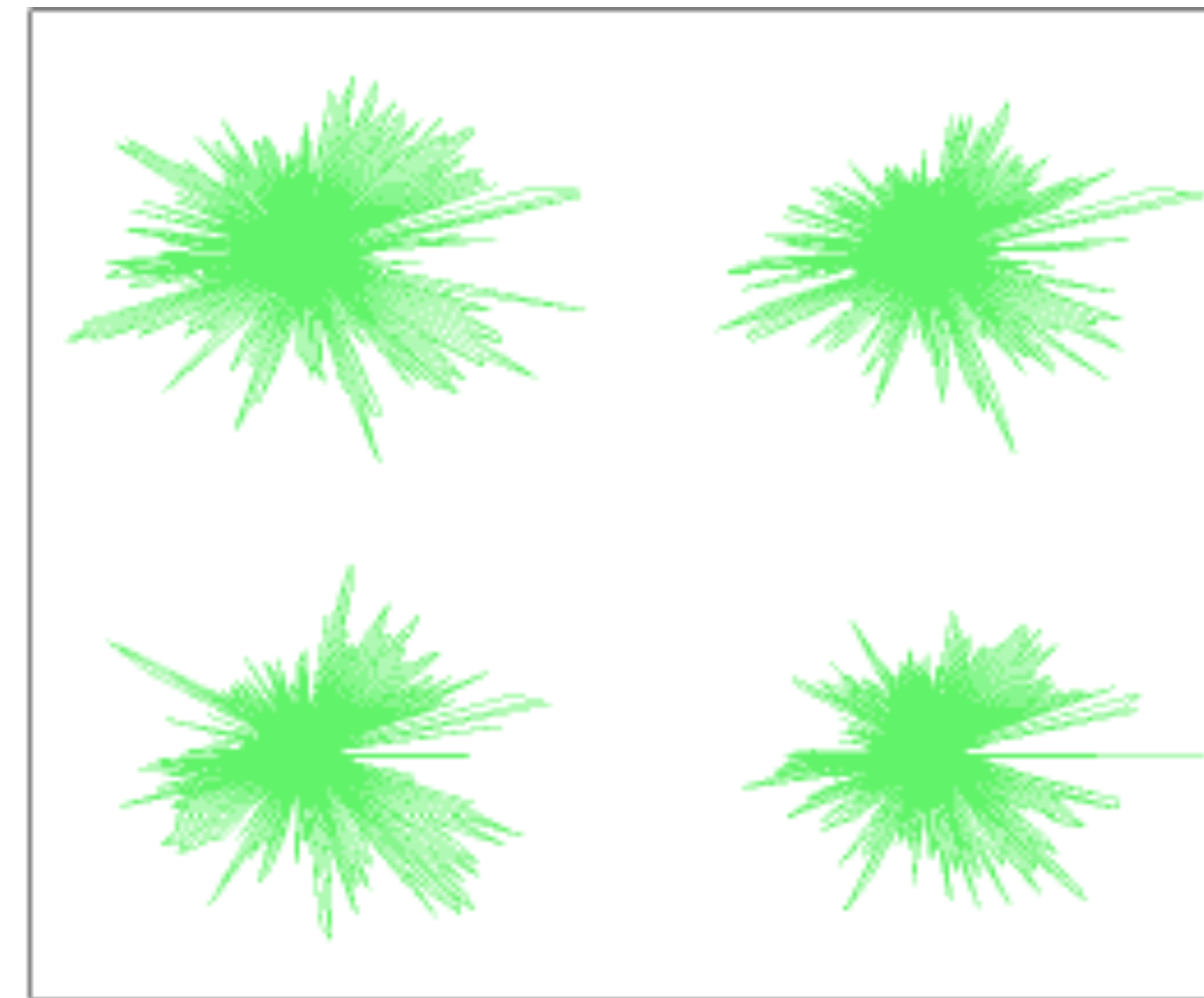
Star Plot / Radar Chart
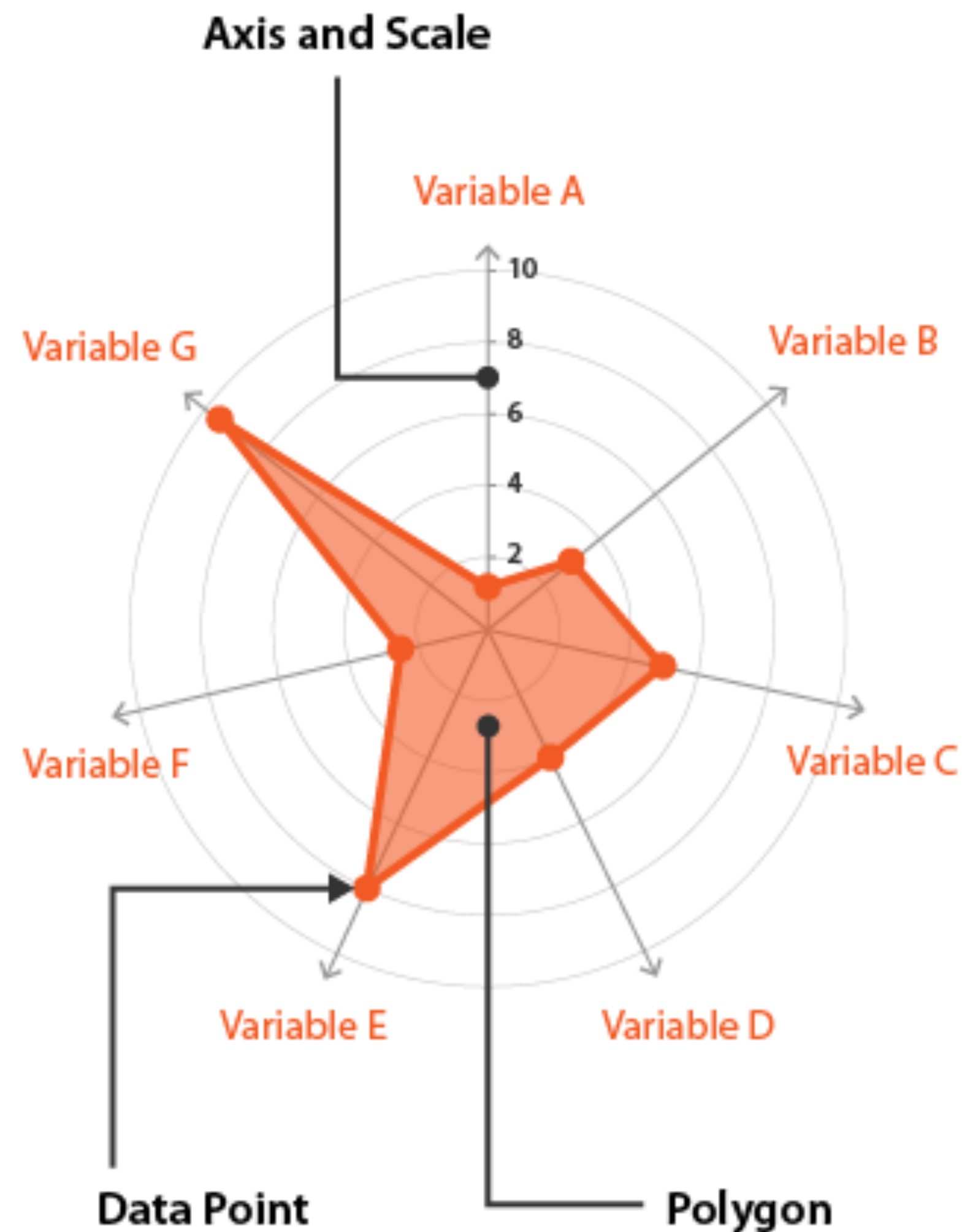
- Use:
  - Compare variables
  - Similarities/differences of items
  - Locate outliers
- Considerations:
  - Order of axes
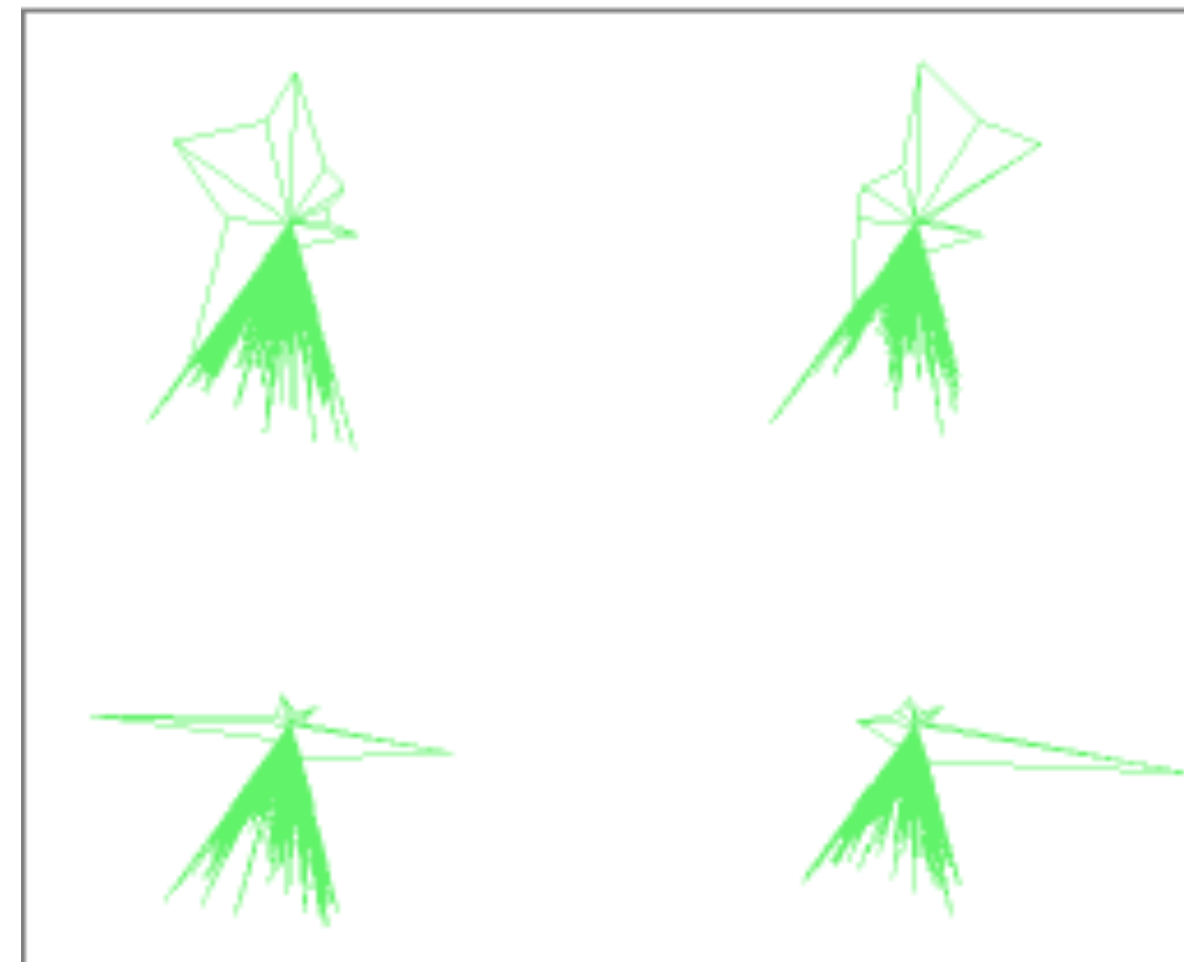 - Too many axes cause problems

[S. Ribecca]

Attribute Filtering on Star Plots
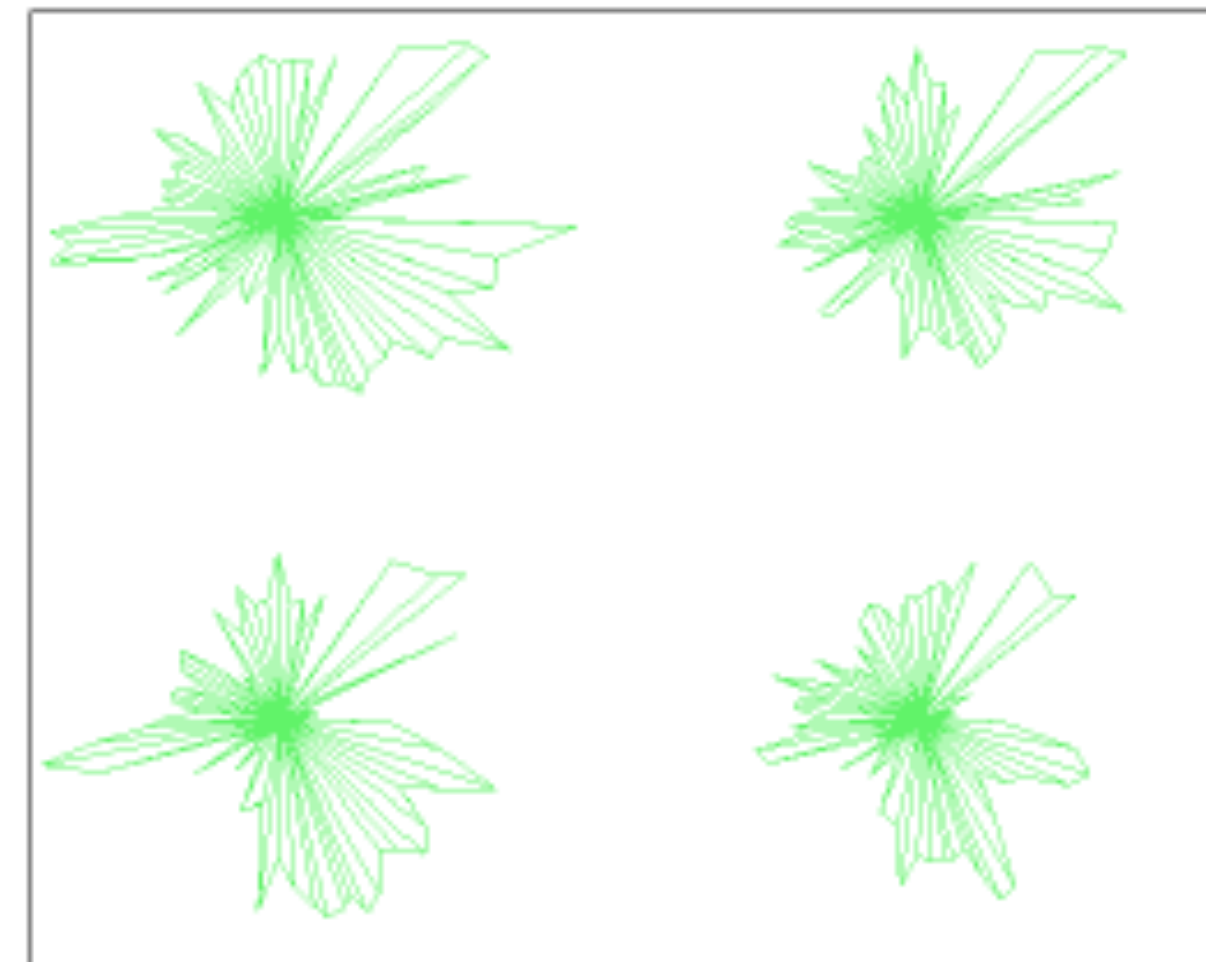

(a)　　　　　　　　(b)

(c)　　　　　　　　(d)

[Yang et al., 2003]

Attribute Filtering

- How to choose which attributes should be filtered?
  - User selection?
  - Statistics: similarity measures, attributes with low variance are not as interesting when comparing items

- Can be combined with item filtering