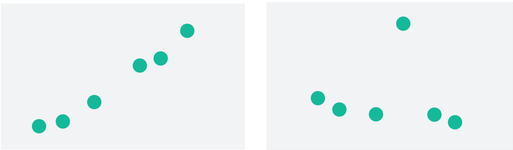
Information Visualization

Multiple Views

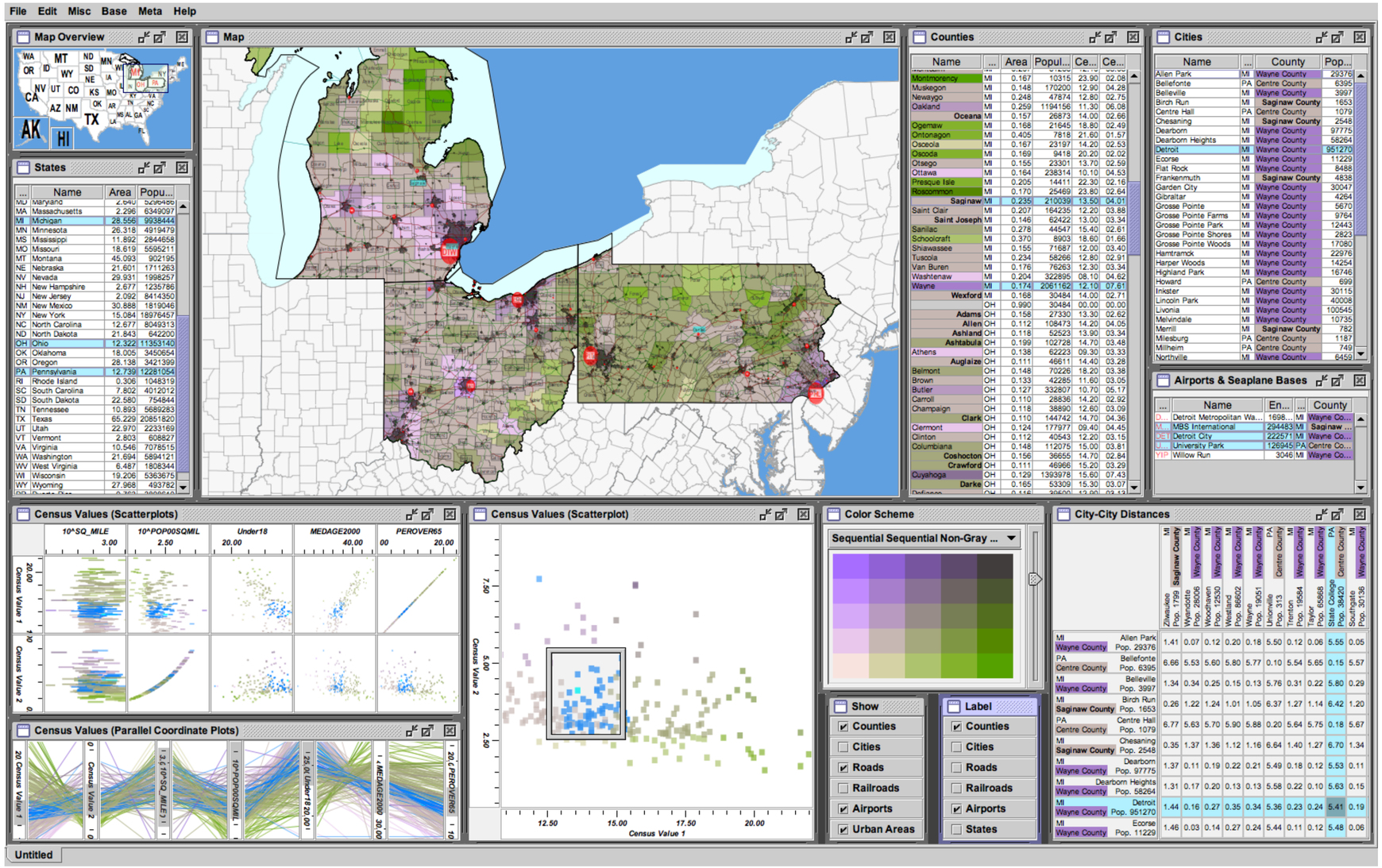
Dr. David Koop

Multiple Views

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

[Munzner (ill. Maguire), 2014]

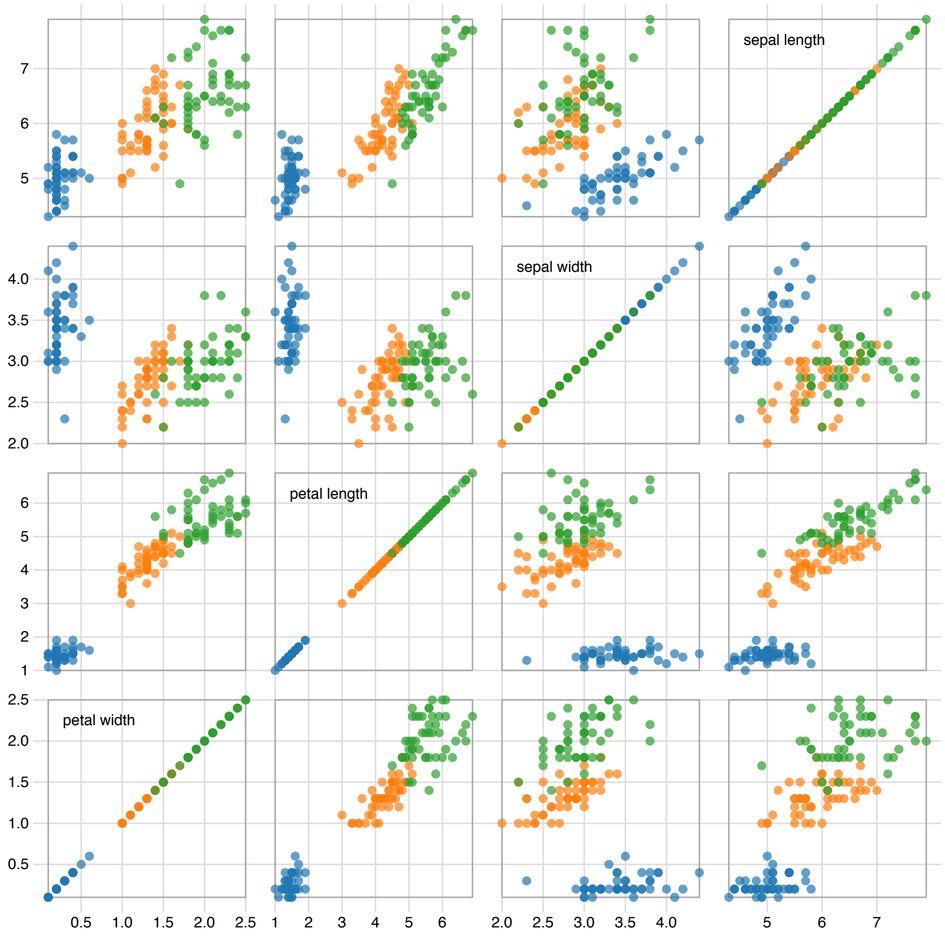
Multiform



[Improvise, Weaver, 2004]

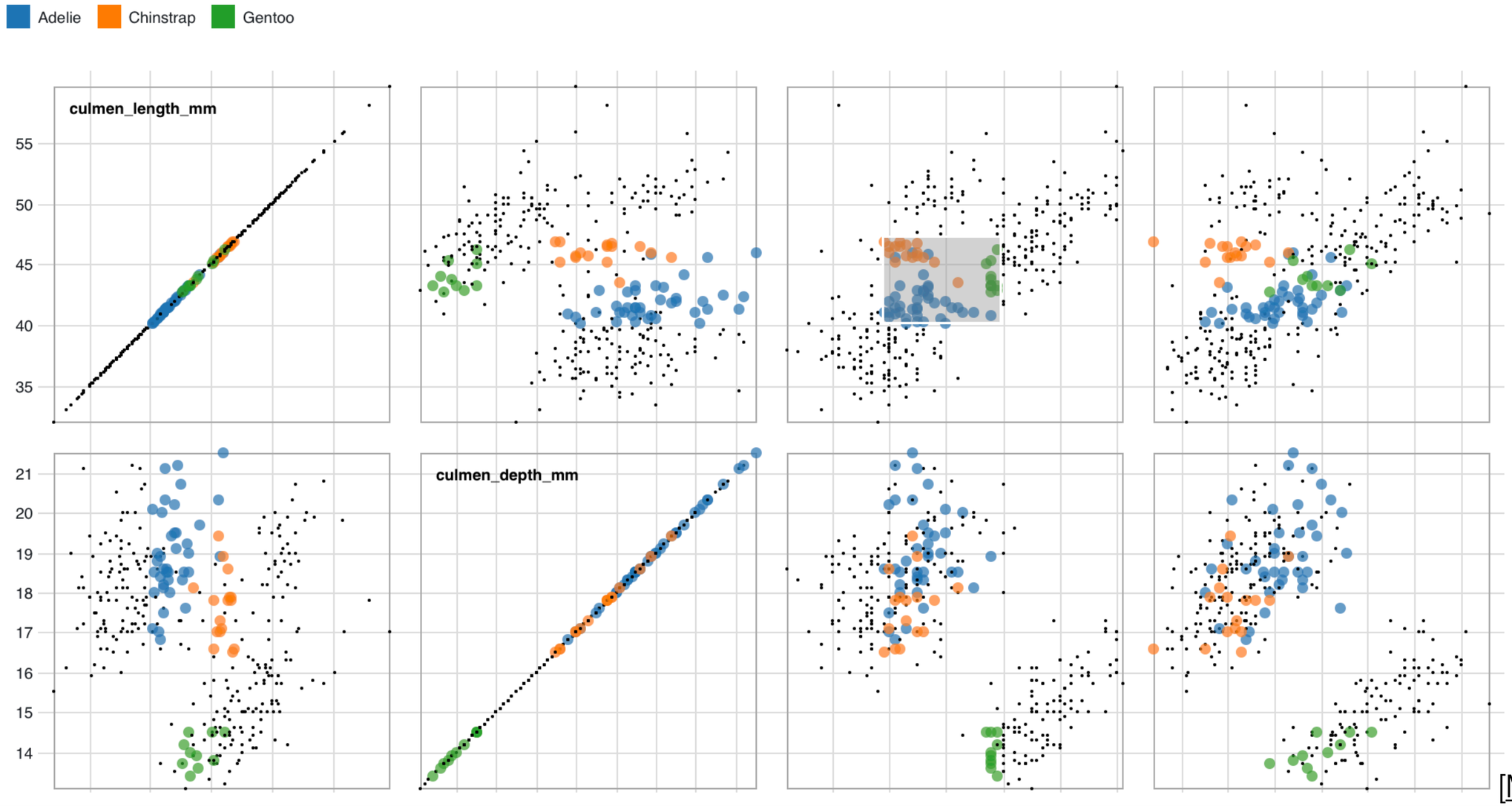
Small Multiples

- Same encoding, but different data in each view (e.g. SPLOM)



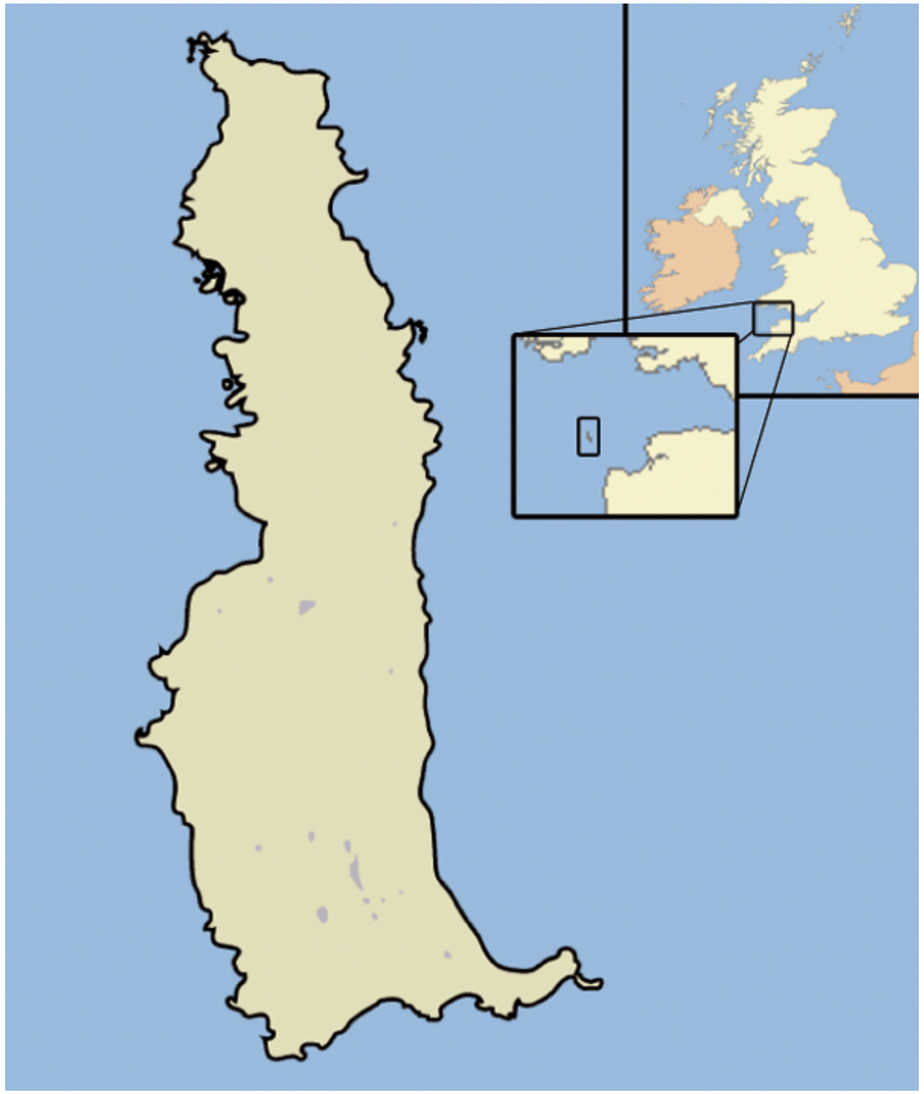
[M. Bostock]

Brushing



[M. Bostock]

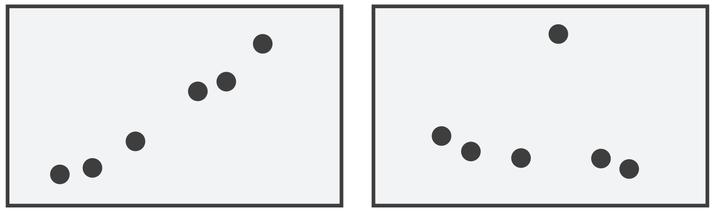
Overview-Detail View



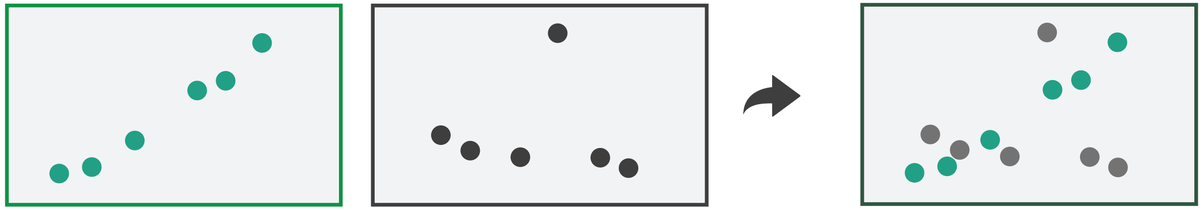
[Wikipedia]

Multiple Views

- **Partition into Side-by-Side Views**

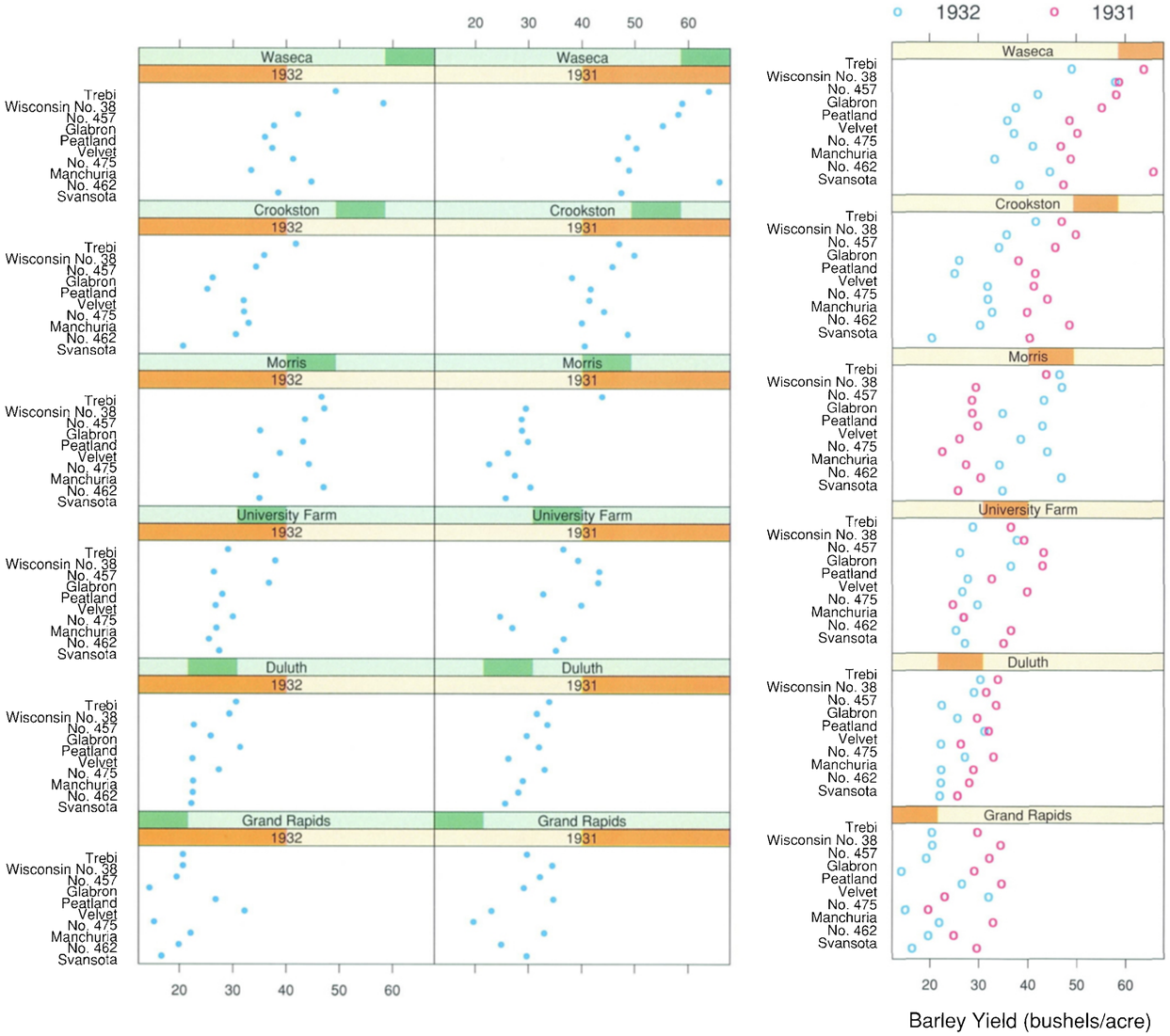


- **Superimpose Layers**



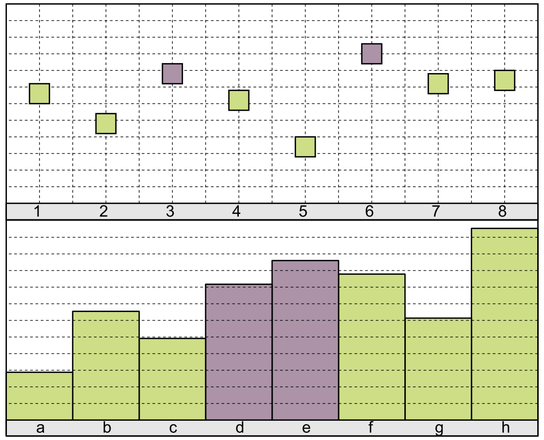
[Munzner (ill. Maguire), 2014]

Example: Trellis Matrix Alignment

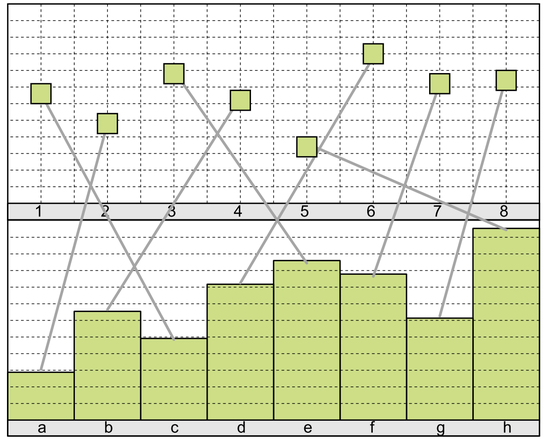


[Becker et al., 1996]

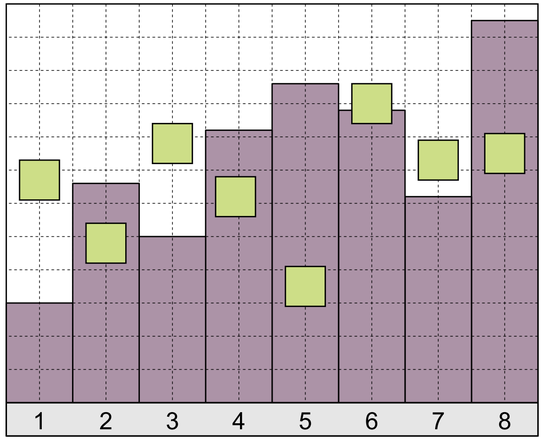
Composite Visualization Techniques



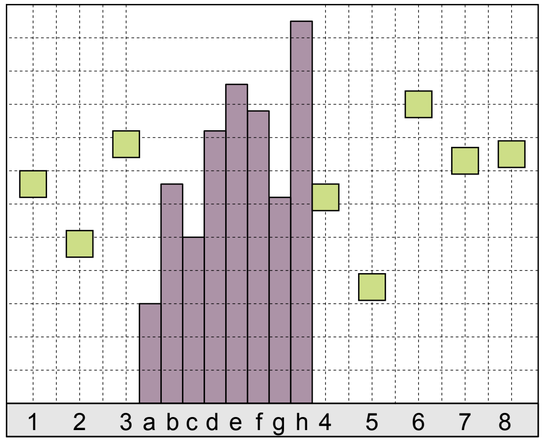
(a) Juxtaposed views.



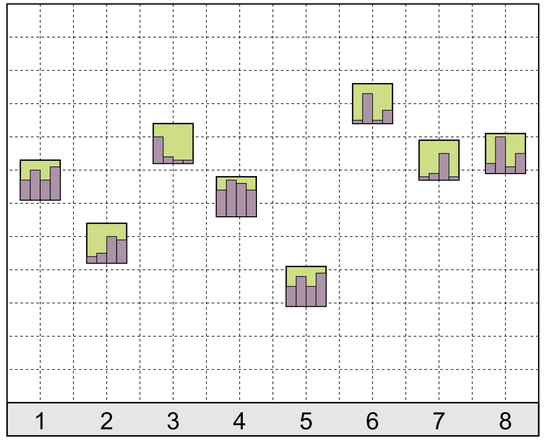
(b) Integrated views.



(c) Superimposed views.



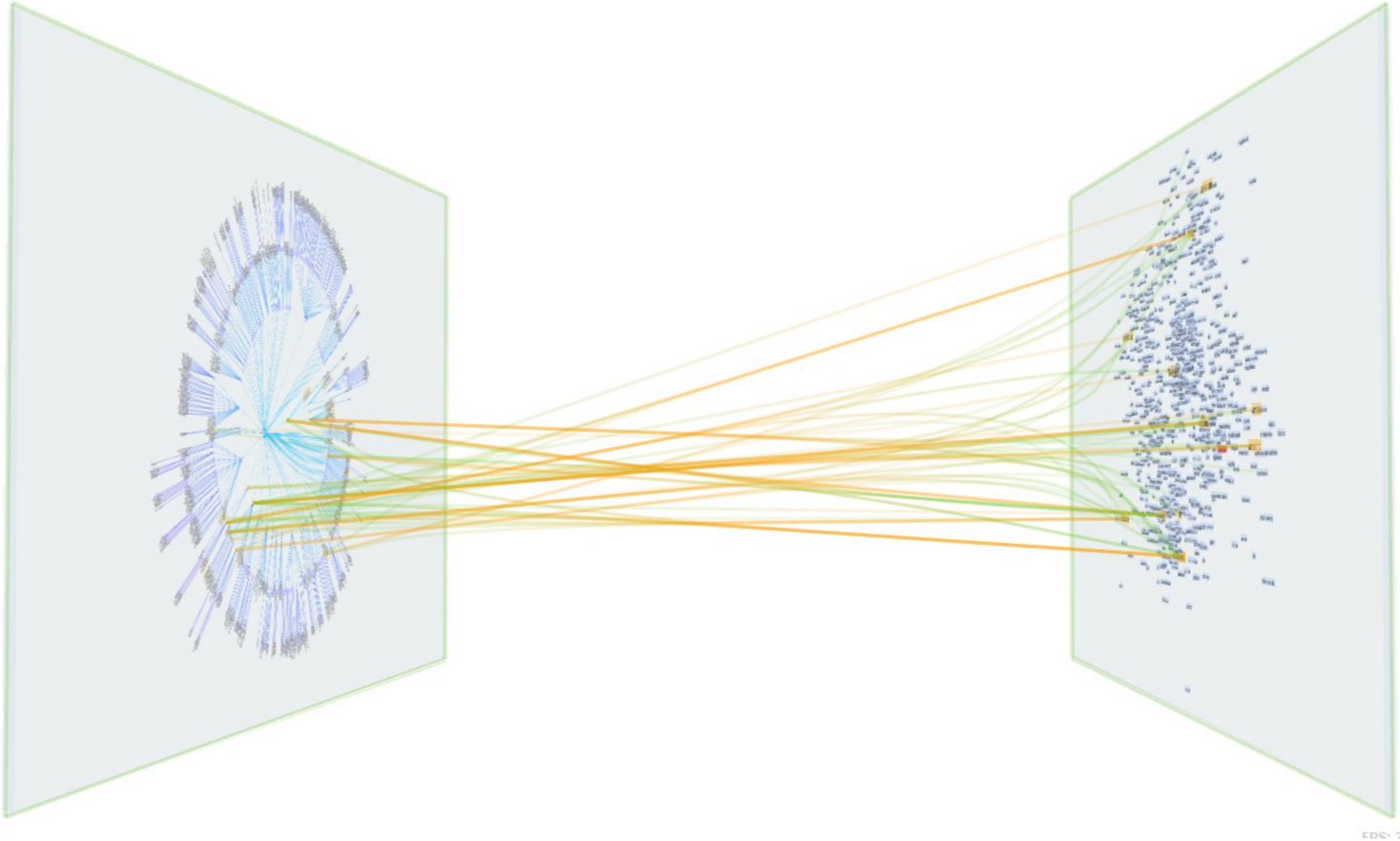
(d) Overloaded views.



(e) Nested views.

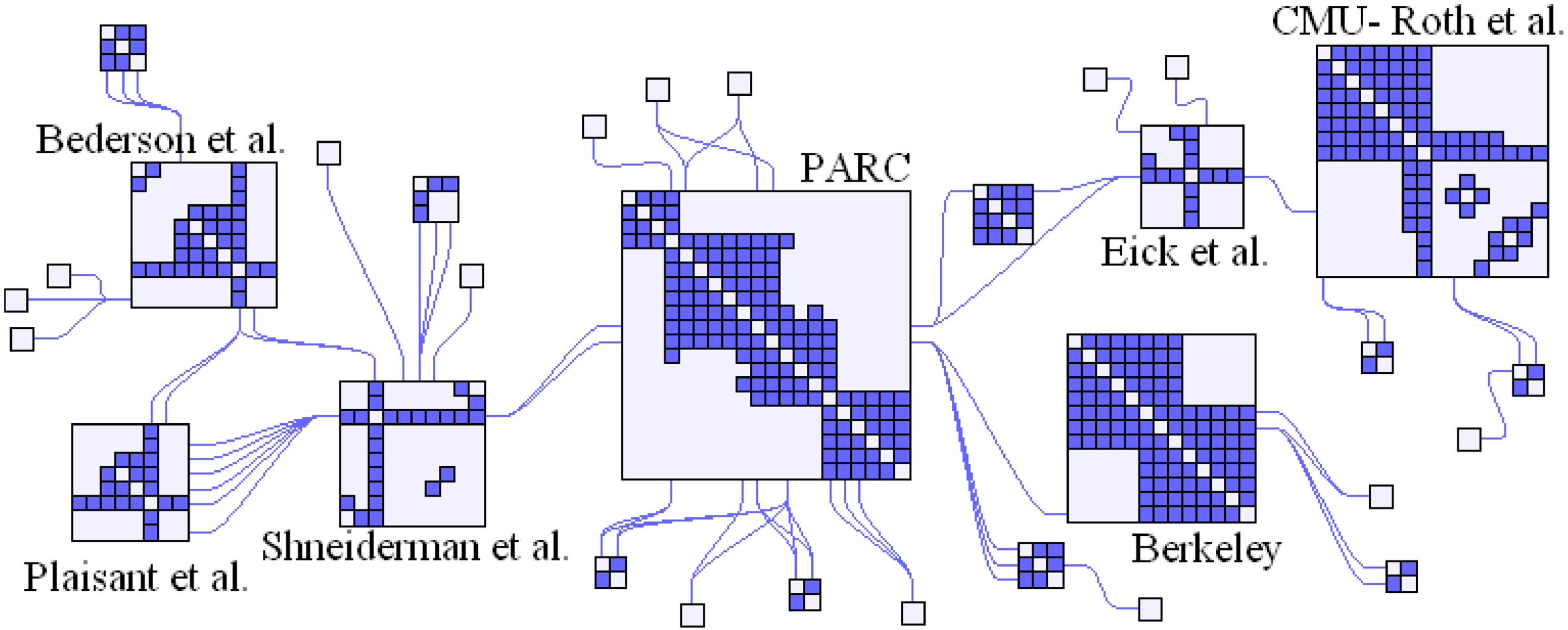
[W. Javed and N. Elmqvist, 2012]

Integration



[VisLink, Collins and Carpendale, 2007]

Nesting



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

Visualization on Devices other than Personal Computers

VisTiles

[Langner, Horak, and Dachselt, VIS 2017]

David Meets Goliath

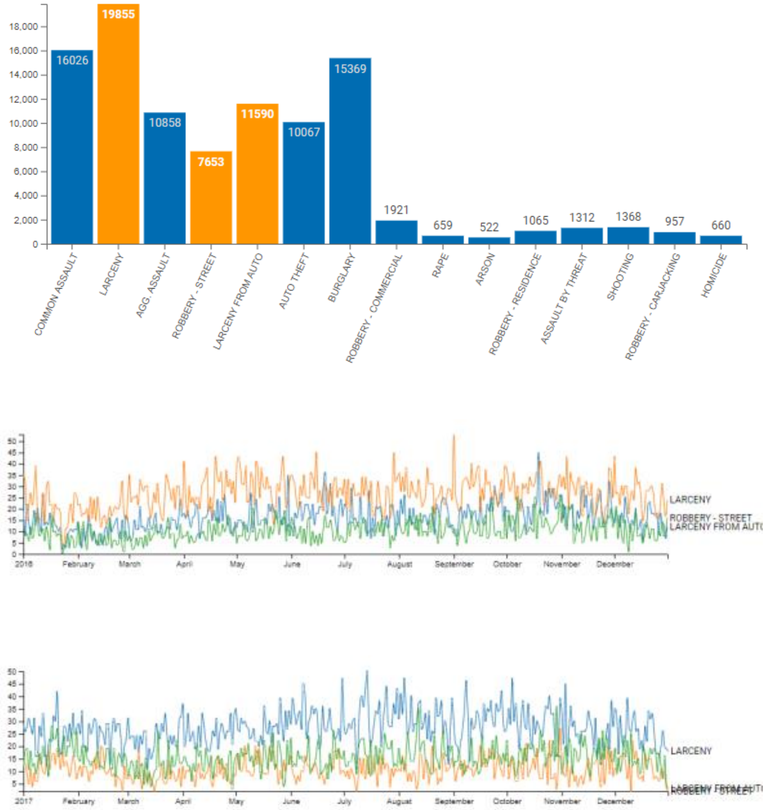
[Horak, Badam, Elmqvist, and Dachselt, CHI 2018]

Now: **Large Wall-sized Displays**

More data More views More users

[R. Langner et al.]

Visualizations are more than just views



Visualizations have a rich body of characteristics and certain relationships to other visualizations

Visualization Type

Encoding

Size

Data Points

Visual Density

Internal State

Axis

Data Source

Idea: Considering these aspects alongside device properties and user preferences

[Horak et al., 2019]

Heuristics for MV Layout

1 Visual Similarity promotes comparison

*If two views are **visually very similar**, they should be both **juxtaposed and aligned**.*

2 Data Similarity indicates alternative representations

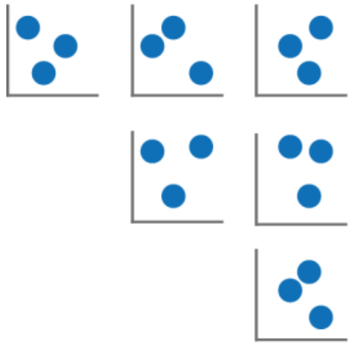
*If two views have a **high degree of data similarity** and a corresponding visual similarity, they should be **placed close to each other**.*

3 Input Connectivity fosters the data exploration

*If an interface component serves as **data input for others**, it should be **placed close to the affected** components.*

Example: Small multiples

Example: Scatterplot matrix

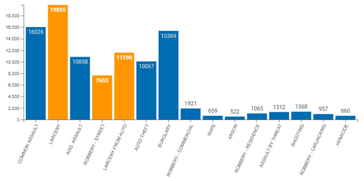


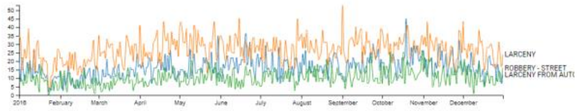
Example: Dashboard

[Horak et al., 2019]

Heuristics for MV Layout

4 Data Density influences the space requirement





*A view should be **allocated space proportional** to the **number of data points** it encodes.*

5 Device Suitability differs for all visualizations

*If devices are diverse, **view assignments** should be **guided by device suitability**.*

[Horak et al., 2019]

Heuristics for MV Layout

6 User preferences always exists

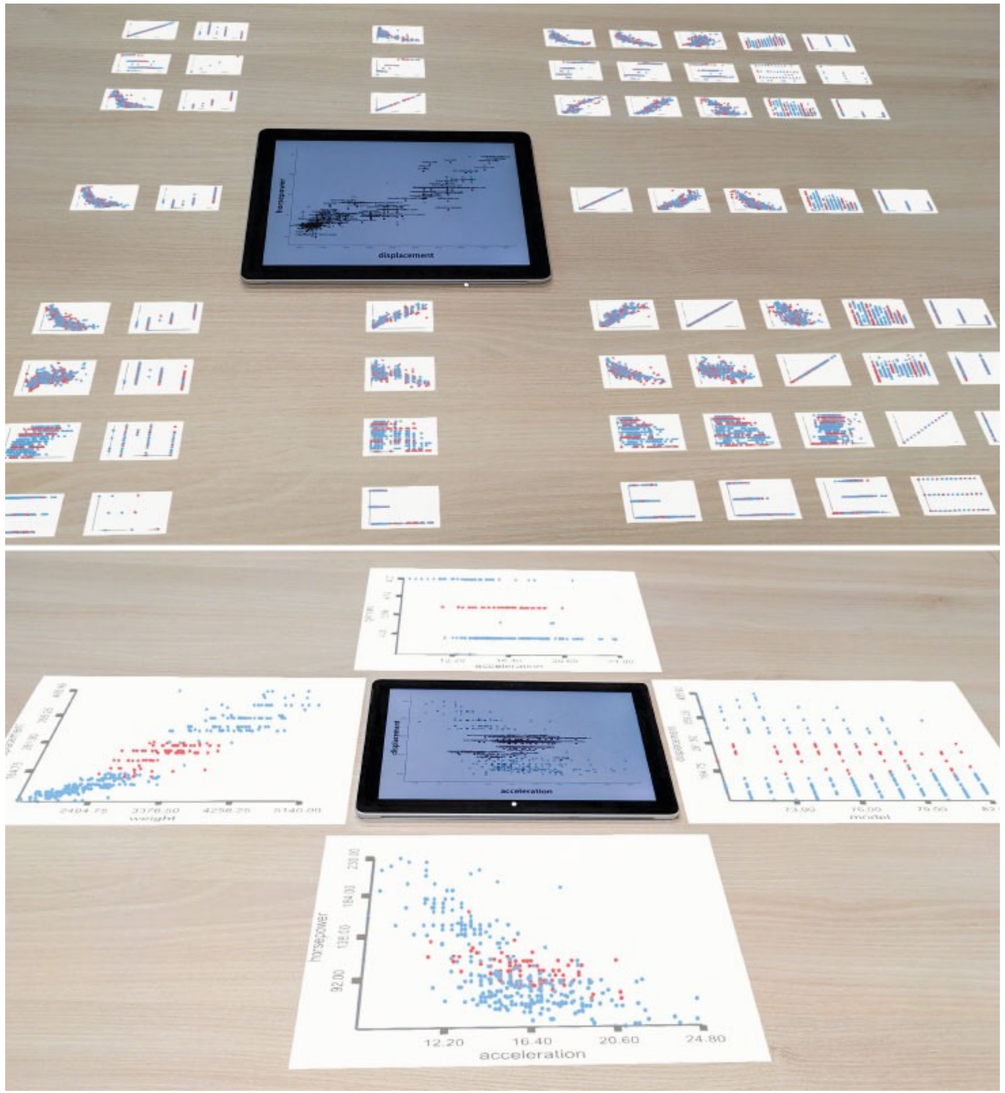
*If user **preferences** are applicable, they **outweigh all other heuristics**.*

Users can have **static** preference about specific distribution details

In the context of analysis tasks, **temporary** user interest can occur

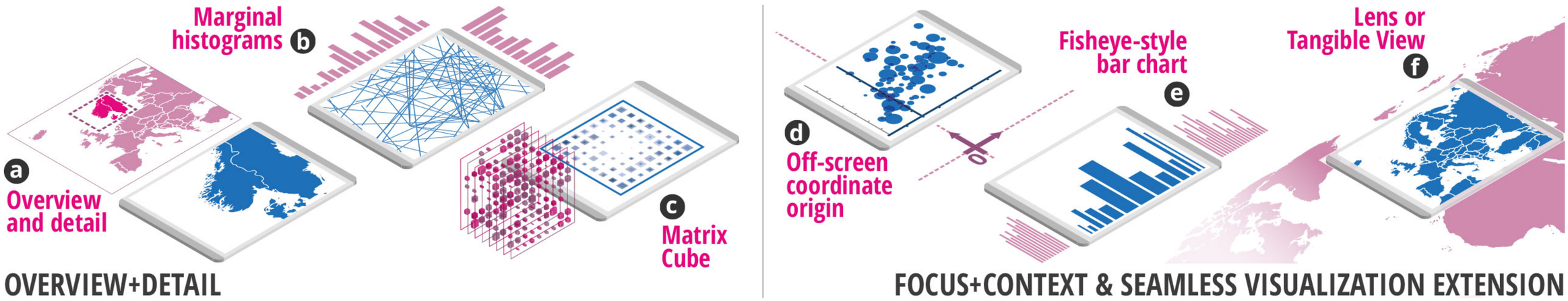
[Horak et al., 2019]

Adding Augmented Reality



[Langner et al., 2021]

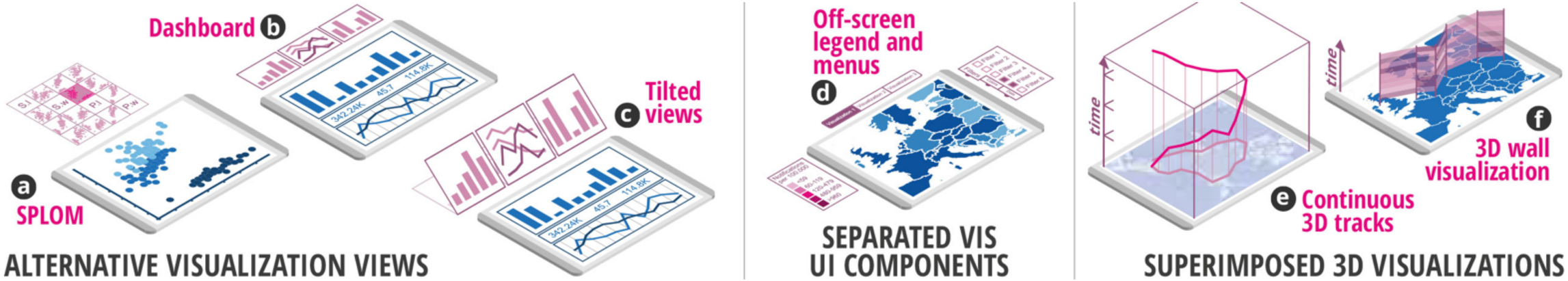
Using Tablets and Augmented Reality



Using AR for adapting different *Overview+Detail* and *Focus+Context* techniques. (a) A typical map overview; (b) Marginal histograms around the mobile device; (c) 3D visualization of a Matrix Cube; (d) Navigation support by an off-screen coordinate origin; (e) Zoomed in bar chart with fisheye-style continuation; (f) Mobile device as a detailed lens into a larger map;

[R. Langner et al.]

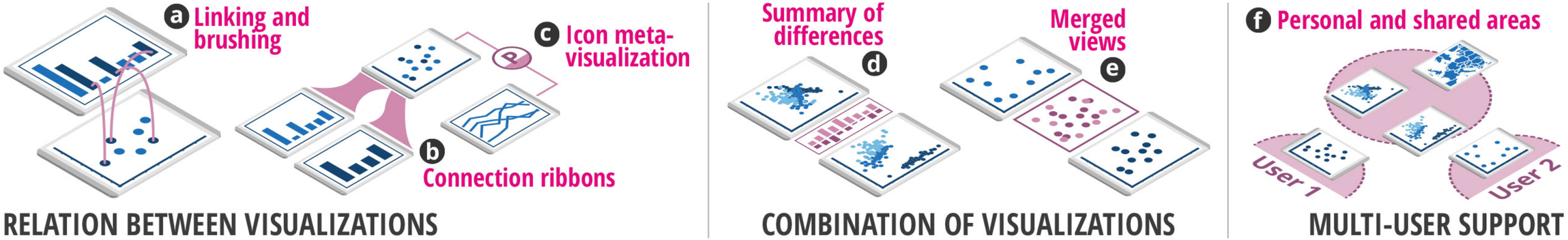
Using Tablets and Augmented Reality



Using AR for *Alternative Visualization Views*, *Separated Visualization User Interface Components*, and *Superimposed 3D Visualizations*. (a) SPLOM shows alternative scatterplots configurations; (b) Distributed views of a dashboard; (c) Tilted AR views; (d) Off-loaded legend and menus; (e) Continuous 3D track above a map; (f) 3D wall visualization aligned to a map;

[R. Langner et al.]

Using Tablets and Augmented Reality



Using AR for *Relations Between Visualizations*, *Combination of Visualizations*, and *Multi-User Support*. (a) Linking and brushing supported by curved AR connections; (b) Ribbons between devices indicate the relative proportions; (c) Icon meta-visualizations reveal view relations; (d) AR bar chart summarizes calculated differences between views; (e) Merging two views in AR; (f) Personal and shared areas for collaborative activities;

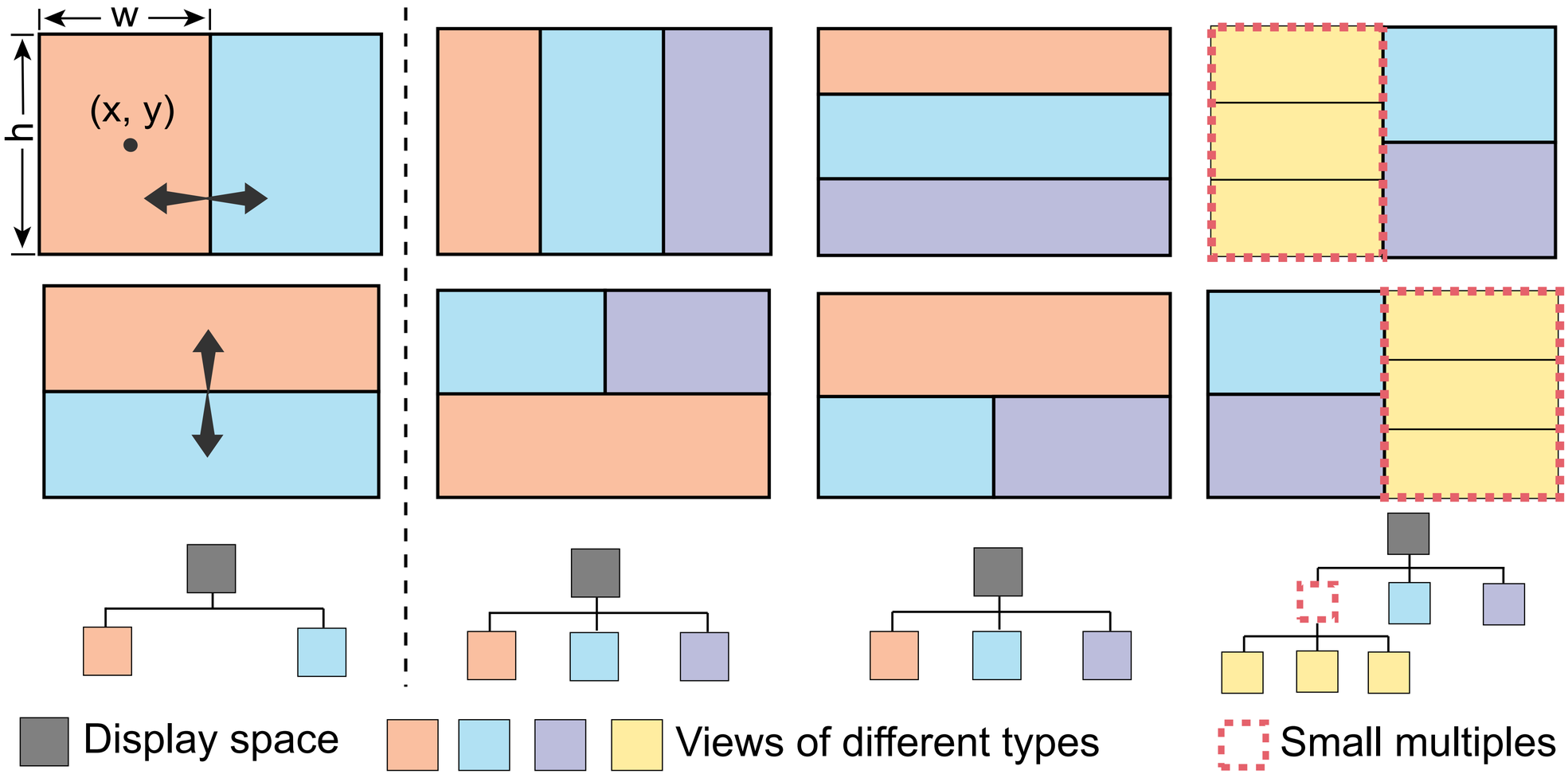
[R. Langner et al.]

Schedule

- Critique Today
- Teaching Evaluations Today
- Progress Reports next Tuesday
- Presentations after Thanksgiving
- Papers due at the end of the semester

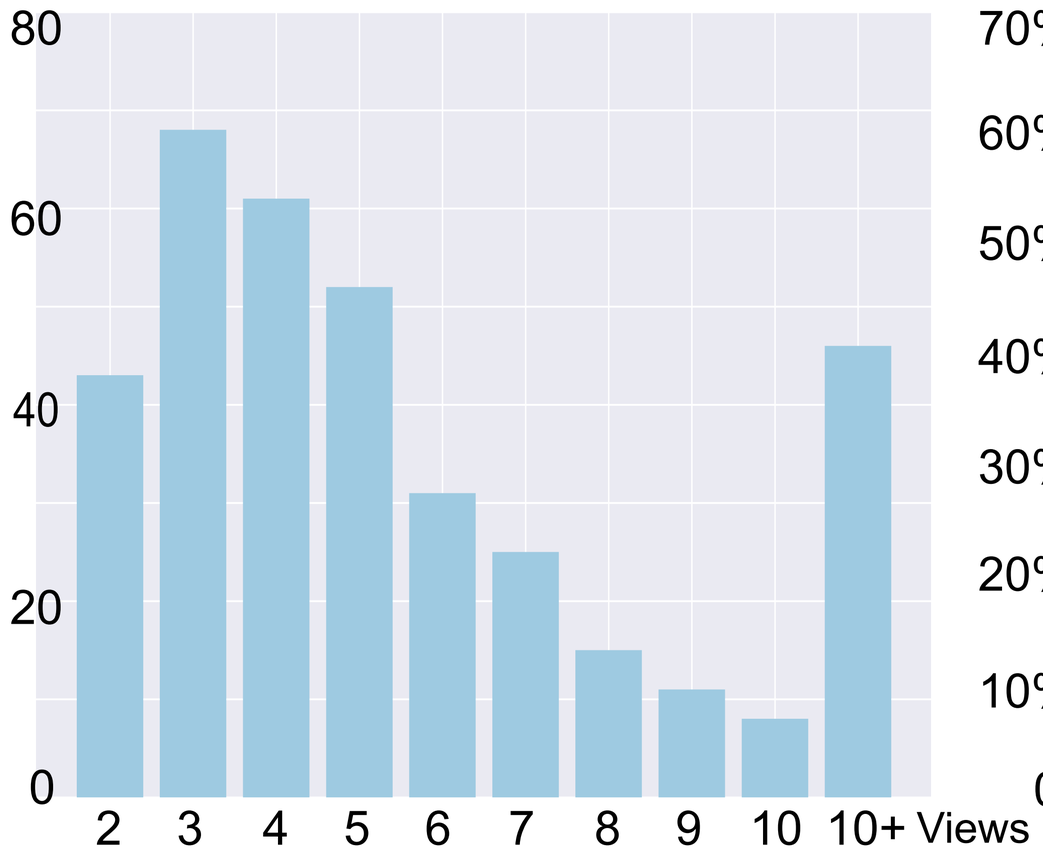
Layouts in Multiple Views

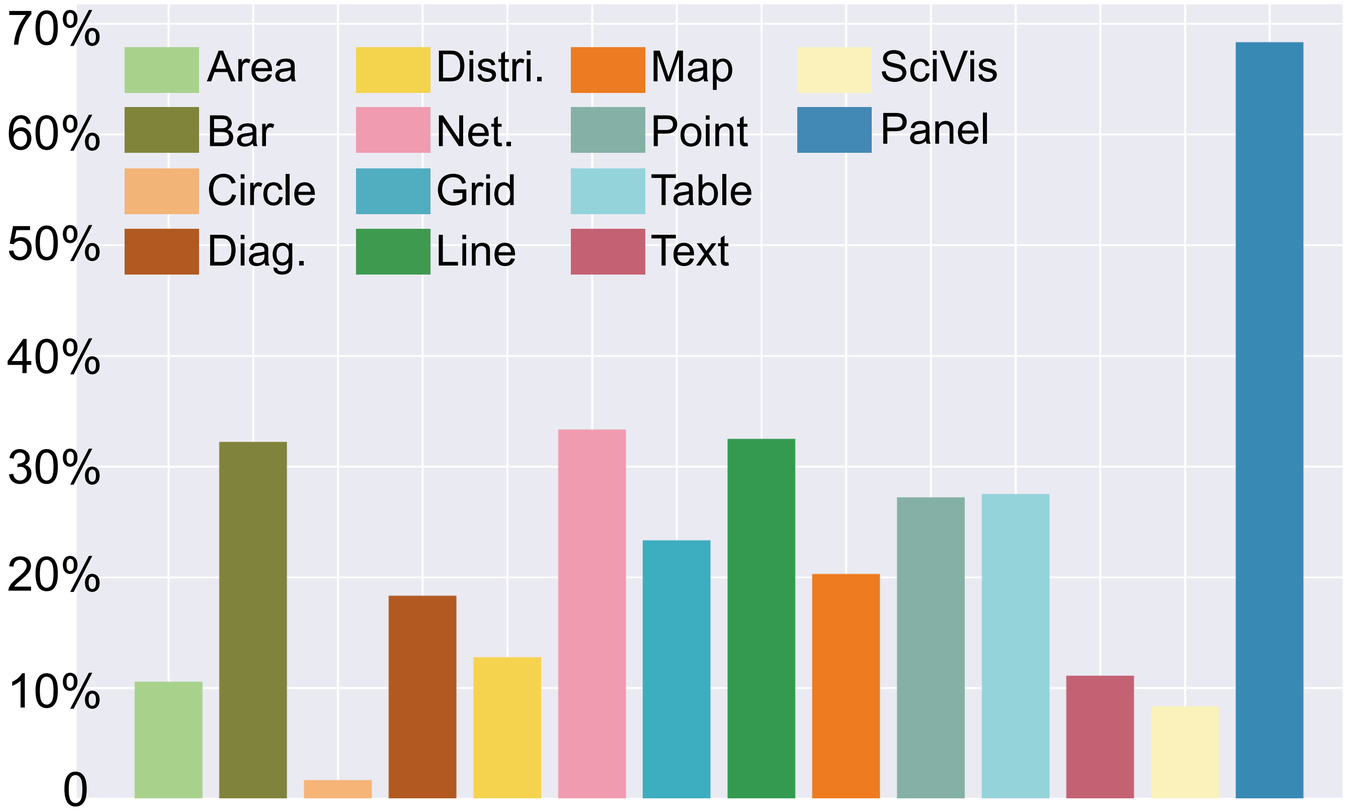
Classifying MV Layouts



[Chen et al.]

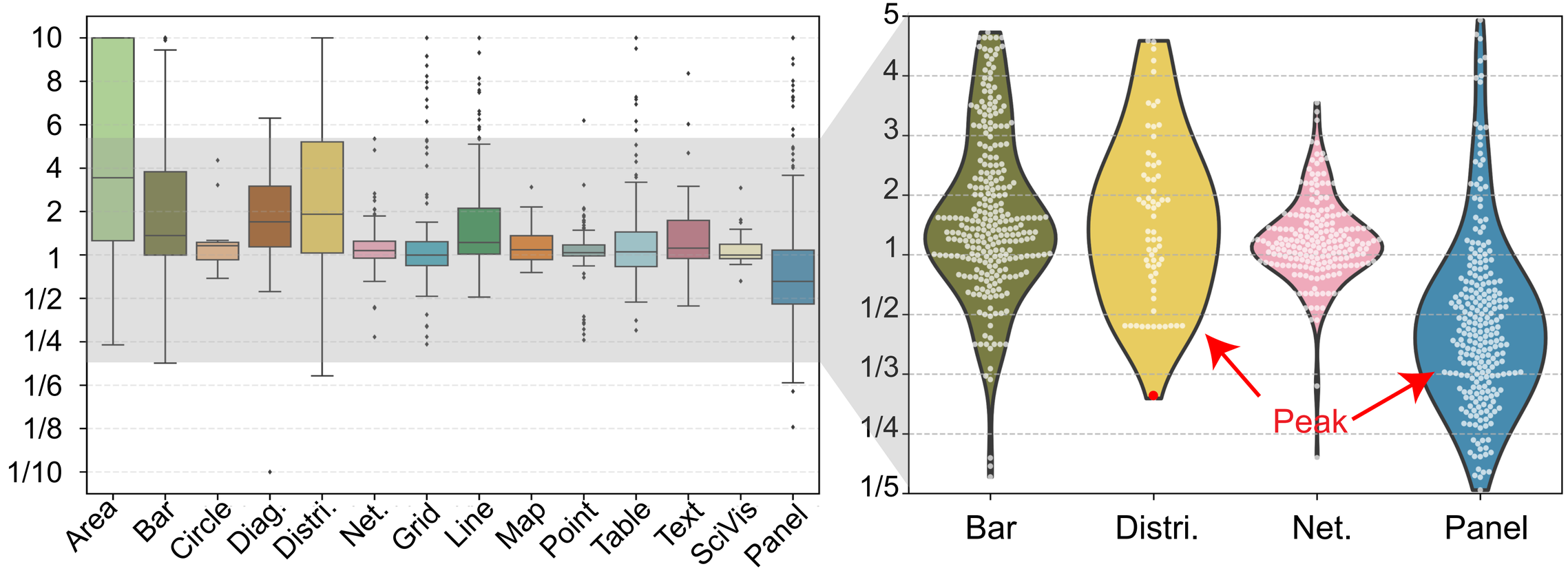
Frequency of View Count & Type





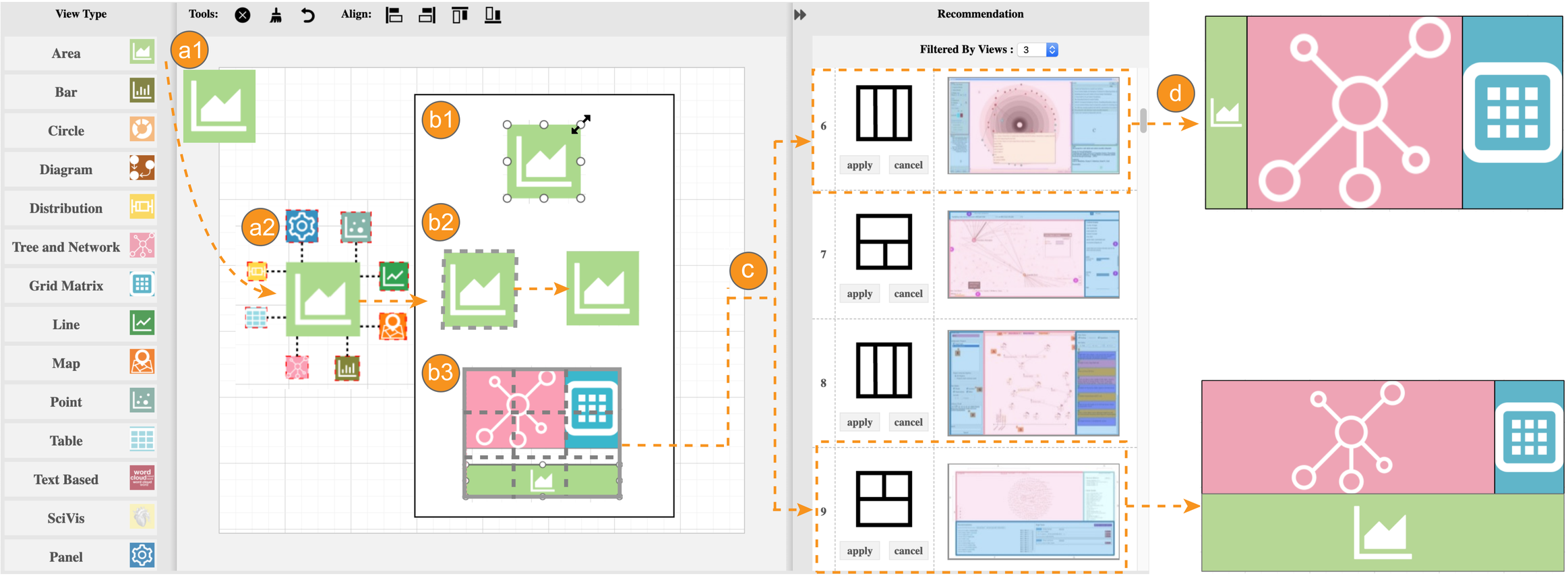
[Chen et al.]

View Aspect Ratio Distribution



[Chen et al.]

Recommendations for MV Layout



[Chen et al.]

Today's Paper

Lingdan Shao · Zhe Chu · Xi Chen · Yanna Lin · Wei Zeng

Modeling layout design for multiple-view visualization via Bayesian inference